PHYSICS ABSTRACTS

SECTION A

of

SCIENCE ABSTRACTS

SECTION A, PHYSICS

SECTION B, ELECTRICAL ENGINEERING

Edited and Issued Monthly by

THE INSTITUTION OF ELECTRICAL ENGINEERS

In Association with

THE PHYSICAL SOCIETY

THE AMERICAN PHYSICAL SOCIETY

THE AMERICAN
INSTITUTE OF ELECTRICAL ENGINEERS

ABSTRACTS 1976–2289

VOLUME 51 **AUGUST 1948** NUMBER 608

PRINCIPAL CONTENTS

August 1948

		PAGE
51	**MATHEMATICS**	201
52	**ASTRONOMY. ASTROPHYSICS. GEODESY**	201
53	**PHYSICS**	203
530.1	**Fundamentals**	203
530.145	Quantum theory	203
531	**General mechanics. Mechanics of solids**	204
531.7	**Mechanical measurements**	204
532	**Mechanics of liquids**	204
532.6	**Capillarity**	205
532.7	**Kinetic theory of liquids**	205
533	**Mechanics of gases**	205
533.7	**Kinetic theory of gases**	206
534	**Vibrations. Acoustics**	206
534.2	Propagation	206
534.321.9	Ultrasonics	206
535	**Optics. Radiation. Spectra**	207
535.317	Geometrical optics	208
535.33/.34	Spectra	208
535.34	Absorption	209
535.37	Luminescence	210
535.4	Interference. Diffraction	211
535.5	Polarization	211
535.8	Optical instruments	211
536	**Heat**	212
536.7	**Thermodynamics**	212
537	**Electricity**	213
537.226	Dielectrics	213
537.3	**Electric currents**	213
537.5	**Electric discharges and radiations**	213
537.533	Cathode rays	214
537.54	Discharge tubes. Counters	214
537.591	**Cosmic rays**	215
538	**Magnetism**	216
538.3/.5	**Electromagnetism. Electrodynamics**	217
538.6	**Magnetic effects**	217
539	**Atomic and molecular structure**	217
539.152.1/.2	Nucleus	217
539.155.2	Isotopes	218
539.16/.18	**Radioactivity. Nuclear disintegration. Nuclear particles**	218
539.172	Nuclear transmutation	220
539.18	Neutrons. Mesons	220
539.2	**Structure of solids**	221
539.3/.8	**Elasticity. Strength. Rheology**	222
541	**PHYSICAL CHEMISTRY**	222
541.124/.128	**Reaction kinetics**	222
541.13	**Electrochemistry**	223
541.14	**Photochemistry**	223
541.18/.182	**Colloids. Disperse systems**	223
541.183	**Adsorption**	223
541.4/.6	**Chemical structure**	224
543/545	**Chemical analysis**	224
548	**CRYSTALLOGRAPHY**	224
549	**Mineralogy**	226
55	**GEOPHYSICS**	226
551.5	**Atmosphere. Meteorology**	227
57/59	**BIOLOGY**	227
61	**Medical science. Human physiology**	227
666	**Glass. Ceramics**	228
669	**Metallurgy**	228
77	**PHOTOGRAPHY**	228

The headings printed in bold type will be found in the text. The others may be located by their U.D.C. number.

RELATED SUBJECTS CONTAINED IN SECTION B (ELECTRICAL ENGINEERING ABSTRACTS)

Mechanical testing
Non-destructive testing
Industrial radiography
Corrosion
Electrical and magnetic measurements and instruments
Electronic relays and counters
Automatic control mechanisms
Applied electrochemistry
Photocells
Thermionic tubes
Cathode-ray tubes
X-ray tubes
Induction accelerators
Cyclotrons
Amplifiers
Radio-wave propagation
Mechanical engineering
Heat engines
Illumination
Metallurgy

NOTE ON THE ARRANGEMENT OF ABSTRACTS

The Abstracts are classified by subject according to the Universal Decimal Classification, and arranged in order of their U.D.C. numbers, which are printed at the head of the Abstract on the left. Abstracts on any particular subject can be located by first consulting the abridged tables of the U.D.C. published with the January number, or the Annual Alphabetical Subject Index, and then referring to the appropriate U.D.C. number in the text. The main headings are listed above.

An Abstract of interest under more than one head has additional U.D.C. numbers, linked by the colon sign, ":" e.g. "536.21 : 548.0 Conduction of heat in crystals." The Abstract is printed once only, under the main number, e.g. in the section "HEAT 536," but Cross-references are inserted under the other numbers, e.g. "548.0 : 536.21 *see Abstr.* 1234" in the section "CRYSTALLOGRAPHY 548." These Cross-references should be investigated, therefore, when a particular section is being searched, as they contain additional matter relevant to that section. A Cross-reference does *not* refer to the Abstract which appears immediately above it.

[*Continued on page* 3 *of cover*

MATHEMATICS 51

53 1976
pplication of the Laplace transform in the solution of r integral equations. ROBINSON, L. B. *J. Appl. ., 19,* 237–41 (*March,* 1948).—Integral equations are ied and references are given to the Laplace transform nique. Most of the operations used are illustrated ugh a solution of Abel's integral equation. It is n that the Liouville–Neumann series follows logically an operational solution of Volterra's integral of the nd kind. Whittaker obtained solutions to the integral tion with the kernel expressed in the last 3 forms. same solutions are shown to be obtainable more tly through the operational calculus based on the lace transform. A.

3 1977
omographs for computing exponential relationships. ADA, A. H. *Gen. Elect Rev.,* **51,** 44–7 (*March,* 1948). ives nomographs enabling the function ε^{-apl} to be l off as a function of two variables, p and l. This o is used in calculations of absorption of radiation by s. Another chart gives ε^{-ac}. Electrical applications mentioned. N. C.

3 : 535.243 *see Abstr.* 2057

42 1978
yrograms for simple harmonic systems subjected to rnal forces. ROJANSKY, V. *J. Appl. Phys.,* **19,** -301 (*March,* 1948).—A graphical method is described the approximate integration of equations of the form $md^2x/dt^2 + kx = f(t)$. The graphs, named "gyrograms," are an extension of the familiar "reference circle" used in representing s.h.m. The method is applicable whenever $f(t)$ can be adequately approximated by a step function having a few steps. A.

518.5 = 3 1979
An electrical calculator for circular functions. HOPPE, W. *Z. Naturforsch.,* **2a,** 585–6 (*Oct.,* 1947) *In German.*

518.5 : 621.318.572 1980
An automatic simultaneous equation computer and its use in solving secular equations. ADCOCK, W. A. *Rev. Sci. Instrum.,* **19,** 181–7 (*March,* 1948).—[Abstr. 1751 B (1948)].

519.27 1981
Least-squares' fitting of data by means of polynomials. BIRGE, R. T. **(Mathematical Appendix,** WEINBERG, J. W.) *Rev. Mod. Phys.,* **19,** 298–360 (*Oct.,* 1947).—A discussion of the fitting of polynomials to equally spaced data. The method of Birge and Shea is suggested as being suitable for physical scientists. A development of this method, using orthogonal polynomials as defined by Aitken, is described. It is claimed that the method is simple and rapid when an electrical calculating machine is used, though Aitken's method may be preferable when a printing adding-machine is employed. The importance of estimating "probable errors" of extrapolated values is emphasized. N. L. J.

ASTRONOMY . ASTROPHYSICS . GEODESY 52

.56 : 522.982 = 3 1982
On the influence of periodic screw-errors on the density ribution in spectroheliograms. VON KEUSSLER, V. *Astrophys.,* **24** (*Nos* 3–4) 223–9 (1948) *In German.*—n small periodic errors of the order of 0·002 mm ve very disturbing. A new optical device for testing asuring-spindles is described. A. B.

.56 : 535.33.072 = 3 *see Abstr.* 2068

.61 = 3 1983
emarks on the technique of direct sun photographs ained with long-focus instruments. VON KLÜBER, H., MÜLLER, H. *Z. Astrophys.,* **24** (*Nos* 3–4) 207–22 48) *In German.*—Description of a new photographic tter-arrangement, used successfully in connection with Potsdam Solar Tower, and of a method for the quick ermination of heliographic co-ordinates. A. B.

.617.3 : 523.821.5 = 4 1984
Use of the electronic telescope in stellar photometry. LLEMAND, A., AND LENOUVEL, F. *C.R. Acad. Sci., is,* **225,** 1129–30 (*Dec.* 10, 1947) *In French.*—Gives a t account of observations made at Haute-Provence h a 31-in reflector employing photoelectric apparatus l electron multipliers in conjunction with a fluorescent een. The telescope has been found to be most effective he infrared region 0·8–1·4 μ on late *M*-type stars as nt as visual magnitude 14. E. G. M.

.982 : 522.56 = 3 *see Abstr.* 1982

.12 1985
Some aspects of stellar evolution. I. Direct condensation. Succession condensation. III. The formation of fila-nts. EDGEWORTH, K. E. *Mon. Not. R. Astr. Soc.,* 5 (*No.* 6) 470–90 (1946).—If direct condensation of stars o take place from a rotating cloud of gas and dust, vitational instability fixes a minimum distance between the condensations, and the process must occur at a temperature a few degrees above abs. zero, which is highly improbable. The process will also lead to a value of the angular momentum which is much too high. If successive condensations take place through intermediate sub-galaxies and binary systems, both objections can be met, but clusters of about 10^5 stars and close binaries should both be much more numerous than they are. It is suggested that filaments may have been formed in the intermediate stage. These then break up into fragments forming the actual stars. This hypothesis is free from the previous objections and a natural extension explains the peculiar distribution of angular momentum in the solar system. A. HU.

523.165 : 621.396.822 1986
Frequency variation of the intensity of cosmic radio noise. HERBSTREIT, J. W., AND JOHLER, J. R. *Nature, Lond.,* **161,** 515–6 (*April* 3, 1948).—Measurements have been made on 25 and 110 Mc/s with horizontal $\lambda/2$ dipoles, $\lambda/4$ above ground, and the results are shown on graphs. After allowing for the relative absorbing areas of the two aerials, the external noise factor, both minimum and maximum, is found to $\propto$ (frequency)$^{-0.41}$. Several short bursts were also observed.

523.31 : 537.591 *see Abstr.* 2142

523.5 : 621.396.99 1987
Velocity of meteors measured by diffraction of radio waves from trails during formation. ELLGETT, C. D., AND DAVIES, J. G. *Nature, Lond.,* **161,** 596–7 (*April* 17, 1948).—Successive radar echoes from meteor trails passing at right angles across the aerial beam showed an oscillatory amplitude variation, when recorded on a c.r.o., due to diffraction. The time taken to traverse successive Fresnel zones can be measured, and hence the velocity of

the meteor. Results obtained with the Geminid shower of Dec. 11–13, 1947, and the Quadrantid shower of Jan. 3–4, 1948, are reported. The mean value for the former was 34·4 km/sec; the latter appear to fall in 3 groups, of velocities ~ 22, 34 and 41 km/sec.

523.72 1988

A solar noise outburst at 600 Mc/s and 1 200 Mc/s. LEHANY, F. J., AND YABSLEY, D. E. *Nature, Lond.*, **161**, 645–6 (*April* 24, 1948).—Simultaneous records of solar noise radiation were made at 200, 600 and 1 200 Mc/s. Bursts were observed on 200, but practically none on 600 and 1 200 Mc/s, the level corresponding to black body temperatures of 5×10^5 and 10^6 °K respectively in absence of sunspots, but rising as sunspots appeared. An isolated outburst occurred for 10 min on both the higher frequencies, accompanied by a radio fadeout. No simultaneous outburst was observed on other frequencies.

523.746 : 523.755 : 551.510.535 1989

On the relations between ionosphere, sunspots and solar corona. KIEPENHEUER, K. O. *Mon. Not. R. Astr. Soc.*, **106** (*No.* 6) 515–24 (1946).—Correlation of the u.v. intensity of radiation producing the ionosphere with sunspots and with intensities in 5 303 Å from coronagraph observations shows that below 700 Å the inner corona is $10^5\times$ brighter than the photosphere, varying through the sunspot cycle by a factor of 10. The variations are superposed on a constant background and are caused by extended coronal patches of long life whose intensity is controlled (with a certain delay) by the underlying spot groups. The brightness distribution is the inverse of that at 5 303 Å. Nearer the Lyman continuum, the coronal intensity reverts to that of the flocculi. At $L\alpha$ the flocculi and flares determine the solar radiation.

A. HU.

523.755 : 551.510.535 : 523.746 *see Abstr.* 1989

523.774 : 523.877 = 3 1990

Quantitative spectral analysis of the sun's atmosphere. UNSÖLD, A. *Z. Astrophys.*, **24** (*Nos* 3–4) 306–29 (1948) *In German.*—A careful discussion of solar and laboratory data leads to improved accuracy in the present knowledge of the composition of the solar atmosphere. Physical conditions (temperature, ionization, electron pressure) and absolute numbers of atoms are derived for the different elements. Excellent agreement is found between the composition of the sun, of the star τ Scorpii, and the results of the analysis of meteorites. The cosmic abundance of all elements is discussed, with the conclusion that at least the main sequence stars are of uniform composition.

A. B.

523.775.2 1991

Visual and spectrographic observations of a great solar flare, 1946 July 25. ELLISON, M. A. *Mon. Not. R. Astr. Soc.*, **106** (*No.* 6) 500–8 (1946).—Measures of $H\alpha$ line width suggest that a "radiation burst" lasting 2–3 min occurred at the maximum of this flare. The $H\alpha$ line reached a width of 15 Å and a central intensity of 300% of the continuum; He, Si^+, Fe and Ni lines showed emission or incipient emission. Continuous emission occurred in the orange and red over a small area for a limited time at peak intensity.

A. HU.

523.821.5 : 522.617.3 = 4 *see Abstr.* 1984

523.823 : 523.832 = 3 1992

On the relation between the masses and velocities of stars. GONDOLATSCH, F. *Z. Astrophys.*, **24** (*Nos* 3–4) 330–54 (1948) *In German.*—Repetition of F. H. Seares' investigation of 1922 with new material (stellar masses from Russell–Moore's mass-luminosity curve, mean velocities for the different spectral groups from Wilson, Raymond, and radial velocities from Nordström). Seares' result that the stellar system has already reached equipartition of its kinetic energy is corrected. The stellar system is still far from being statistically stationary, but it shows a tendency to equipartition in a degree which leads to an age of the system of 10^9–10^{10} years, in agreement with present views.

A.

523.832 : 523.823 = 3 *see Abstr.* 1992

523.841.1 : 535.343 = 3 199

What conclusions can be drawn from a given curve of growth? UNSÖLD, A. *Z. Astrophys.*, **24** (*Nos* 3–4) 384–8 (1948) *In German.*—Under certain assumptions, through the graphical representation of the total absorption of Fraunhofer lines against the number of absorbing atoms (the "curve of growth"), statements about the dependence on wavelength of the absorption coefficient can be obtained. Application to the problem of unresolved molecular spectra is indicated.

A.

523.841.37 : 523.877 = 4 199

On the variation of electronic pressure and gravity in δ Cephei with phase. CANAVAGGIA, R. *C.R. Acad. Sci. Paris*, **226**, 466–8 (*Feb.* 9, 1948) *In French.*—Variations in p_e and g are determined from the observed variation in the Balmer discontinuity. The results for g are in qualitative agreement with those deduced for an atmosphere whose instantaneous structure is an equilibrium one corresponding to an effective gravity $g+R$.

R. A. M.

523.842 = 3 199

Photometry of 115 double stars. HOPMANN, J. *Z. Astrophys.*, **24** (*Nos* 3–4) 263–77 (1948) *In German.*

523.842.2 = 4 199

The faint double stars. JONCKHEERE, R. *C.R. Acad. Sci., Paris*, **226**, 65–6 (*Jan.* 5, 1948) *In French.*—This note reviews the results of the work of double star observers over a period of 30 years; the author shows the error in failing to observe the fainter close doubles, which are, in fact, the near pairs of small mass.

E. G. M.

523.842.3 = 4 199

Masses and major axes of spectroscopic binaries. LABEUR, M.-L. *C.R. Acad. Sci., Paris*, **226**, 226–8 (*Jan.* 19, 1948) *In French.*—Durand's methods [Abstr. 201 (1946)] are shown to be applicable to spectroscopic binaries of single spectra and known parallax, yielding accurate values of total masses and of major axes of the relative orbits. A worked example (γ CMi) gives these quantities with errors of ~ 4% and 1·3% respectively, thus bringing such stars into line with visual binaries of known orbit and parallax.

D. L. I.

523.852 199

A red nebula. SCHALÉN, C. *Ark. Mat. Astr. Fys.* **35 A** (*Paper* 34) 3 *pp.* (1948).

523.87 : 523.877 = 4 199

Theoretical study of the spectra of certain white dwarfs. SCHATZMAN, E. *C.R. Acad. Sci., Paris*, **225**, 1282–4 (*Dec.* 22, 1947) *In French.*—It is suggested that a stellar model with pure hydrogen atmosphere and an intense gravitational field can explain the main features of white dwarf spectra. The computed energy distribution in the spectrum background, after allowing for overlapping Balmer lines, is said to agree qualitatively with that in a microphotometer tracing of O_2 Eridani B by Kuiper.

D. L. I.

523.877 200

Note on stellar structure. HOYLE, F., AND LYTTLETON, R. A. *Mon. Not. R. Astr. Soc.*, **106** (*No.* 6) 525–30 (1946).—When radiation pressure is comparable with gas pressure, the effective polytropic index is continuous at

ndary between convective and radiative regions in a if the composition is continuous, but not if it is ontinuous. The physical conditions which must be sfied at the interface are examined and found to be ated by a recent model [Abstr. 575 (1943)] which is efore not physically possible. A. HU.

523.877 : 523.774 = 3 *see Abstr.* 1990

523.877 : 523.841.37 = 4 *see Abstr.* 1994

523.877 : 523.87 = 4 *see Abstr.* 1999

523.91 : 535.417 *see Abstr.* 2094

PHYSICS 53

2001

Discussion on the design of physics laboratories—idon, 1947. *J. Sci. Instrum. Phys. Ind.*, **25**, 157–74 *ay*, 1948).

082 : 621.317.7 : 681.5 2002

Précis of a discussion on "Practical considerations in rument design"—London, 1948. *J. Sci. Instrum. s. Ind.*, **25**, 122–4 (*April*, 1948).

FUNDAMENTALS 530.1

0.1 : 531.15 : 538 2003

Blackett's hypothesis of the magnetic field of rotating lies. Asley, N.; Fuchs, J. *Nature, Lond.*, **161**, 8–9 (*April* 17, 1948).—I. Certain objections to ckett's hypothesis [Abstr. 1715 (1947)] are put ward, and some consequences noted; e.g. a symmetric ating body will thus be surrounded by an electric adrupole field as well as a magnetic field.

I. Dimensional adjustments made to Blackett's uation lead to a new formulation: $2P/U = \mu\sqrt{(\varepsilon/\gamma)}$. = magnetic, U = angular moment, μ = permeability, = permittivity of vacuum, γ = reciprocal gravitational nstant = $1/G$).

0.1 : 538 = 4 2004

Magnetic properties of rotating matter. Gião, A. rz. *Mat.*, **8**, 9–12 (*Nov.*, 1947) *In French.*—Amplifies an rlier discussion of the magnetism of a rotating sphere e Abstr. 3046 (1947)]. R. A. N.

0.12 = 3 2005

The space-time dis-continuum. Küssner, H. G. *Phys. Bl.*, *No.* 9) 290–3 (1947) *In German.*—Discusses the funda- ental ideas underlying the author's book *Principia Physica* öttingen 1946]. The space-time continuum is replaced a dis-continuum, where each point is located by a mber of co-ordinates each of which must be an integral ultiple of an elemental quantity. The discontinuum us forms a "grid" named *topology*. Various funda- ental natural laws when expressed in "topologic" -ordinates become invariant and independent of any etric hypothesis. The topologic form of Maxwell's uations yield the missing relation between field strength d induction of non-homogeneous bodies. Küssner es topology to investigate the interaction of electric and avitational charges. Recent measurements of the agnetic field of the star 78 Virg [Abstr. 1413 (1947)] e said to corroborate Küssner's topologic gravitational- ctric theory. V. W. R.

0.12 = 3 2006

On the singularity in Schwarzschild's solution for = 2*m*. Rabe, E. *Astr. Nachr.*, **275** (*Nos* 5–6) 251–5 *Dec.*, 1947) *In German.*—Considers the radial motion of small test particle in the field of a central mass point. Newtonian mechanics, a particle falling from rest ∞ would acquire the velocity of light at the singular oint. The effect of the singularity in the relativistic olution is to reduce the velocity to zero at this point. R. A. N.

530.12 : 531.51 2007

A static solution of the equations of the gravitational field for an arbitrary charge-distribution. Papapetrou, A. *Proc. R. Irish Acad.*, **51 A**, 191–204 (*Dec.*, 1947).—The author derives the relativistic counterpart of the well-known Newtonian system in which electrostatic repulsion balances gravitational attraction, without referring to the Newtonian system. Pseudo-tensors are used extensively in order to discuss the energy, etc., of the system. It is shown that particles with the requisite charge/mass ratio just fail to possess the Schwarzschild type singularity. H. B.

530.12 : 531.51 2008

A generalized theory of gravitation. Einstein, A. *Rev. Mod. Phys.*, **20**, 35–9 (*Jan.*, 1948).—This is a concise new presentation of the theory developed in two previous papers [Abstr. 1224 (1946); *Ann. Math.*, **47**, 731–41 (1946)]. The fundamental tensor is taken to be Hermitian instead of real and symmetric, and then both the gravitational and the electromagnetic field can be derived from it. The mathematically natural character of this development of general relativity is stressed. H. B.

530.14 2009

The meson field and the equation of motion of a spinning particle. Majumdar, R. C., and Gupta, S. *Nature, Lond.*, **161**, 410–11 (*March* 13, 1948).

530.14 : 538.3 2010

Review of a generalised electrodynamics. Podolsky, B., and Schwed, P. *Rev. Mod. Phys.*, **20**, 40–50 (*Jan.*, 1948).—A review of five papers [cf. Abstr. 1149 (1948); 3426 (1947)] in which a generalized electrodynamics has been developed. This review presents the essential results obtained so far in a uniform sequence, to emphasize the ideas, difficulties encountered and the methods of procedure, since they have been extended as a meson theory avoiding many divergences, and other extensions seem possible. G. J. K.

530.14 : 538.3 2011

On a different form for the interaction between Dirac's electron field (ψ) and Maxwell's electromagnetic field (ϕ, A). Belinfante, F. J. *Phys. Rev.*, **73**, 641 (*March* 15, 1948).—An interaction term $H'\psi = -i(e\hbar/mc)\{\phi(1/c)\dot{\psi} + A \cdot \nabla\psi\}$ in the Hamiltonian instead of the usual term $-e(\phi - A \cdot \alpha)\psi$ gives the same fine structure to the Balmer lines, except that each j-multiplet is inverted. G. J. K.

530.145 = 3 2012

On the problem of the mass stability of the elementary particles. Hönl, H. *Z. Naturforsch.*, **2a**, 537–49 (*Oct.*, 1947) *In German.*—The motion of a particle of the form, mass-point + mass-dipole, is calculated with radiation reaction terms. Self-acceleration occurs as for the Dirac classical electron (mass-point only), but the parameter involved does not depend on the charge. By a correspondence argument, the particle is described as a heavy unstable particle of spin $h/2\pi$ which can spontaneously disintegrate into two particles of spin $h/4\pi$. G. J. K.

530.145 : 537.534.74 : 539.185 2013

The neutron-proton scattering formula. Flügge, S.,

AND HÜCKEL, E. *Phys. Rev.*, **73**, 520 (*March* 1, 1948).—It is claimed that the elementary formula for low energies for a real singlet state must be completely changed in form if the level is virtual, and gives the wrong variation with energy. The virtual level energy defined by the new expression is 1·5 MeV instead of 0·1 MeV. G. J. K.

530.145 : 539.152.1 *see Abstr.* 2170

530.145.6 2014

Note on relativistic quantum mechanics. SNYDER, H. S. *Phys. Rev.*, **73**, 524 (*March* 1, 1948).—The properties and interaction between two particles described by assumed expressions for the Hamiltonian and momentum are obtained by examination of the transformation properties of these expressions under Lorentz transformations. G. J. K.

530.145.6 = 4 2015

On the non-relativistic approximation to the wave equations of a meson in a central field of force. PETIAU, G. *J. Phys. Radium* (*Sér.* 8) **8**, 276–81 (*Sept.*, 1947) *In French.*—The matrix equations of a meson moving under a central force are put in a non-relativistic form in the manner usually adopted with the Dirac equation. The resulting Schrödinger equation contains a vector spin-orbit interaction similar to that for the electron, with spin matrices for spin 1. The first-order relativistic corrections include a spin-orbit tensor interaction. G. J. K.

530.145.6 = 4 2016

On the representation of a particle of spin 1 with several masses. POTIER, R. *C.R. Acad. Sci., Paris*, **226**, 63–4 (*Jan.* 5, 1948) *In French.*—A system of 16 linear equations is given representing a meson of four masses, two of positive and two of negative charge. G. J. K.

530.145.6 : 531.19 : 536.75 = 3 2017

A remark on entropy in wave mechanics. JOST, R. *Helv. Phys. Acta*, **20** (*No.* 6) 491–4 (1947) *In German.*—An ensemble consisting of two ensembles, with weight factors α_1 and α_2 and entropies S_1 and S_2, has an entropy S with a lower bound $S \geqslant \alpha_1 S_1 + \alpha_2 S_2$. It is here proved that there is also an upper bound given by $S \leqslant \alpha_1 S_1 + \alpha_2 S_2 - \alpha_1 \log \alpha_1 - \alpha_2 \log \alpha_2$. G. J. K.

GENERAL MECHANICS . MECHANICS OF SOLIDS 531

531.15 : 538 : 530.1 *see Abstr.* 2003

531.19 : 536.48 = 3 2018

On the applicability at low temperatures of the saddle-point method in the case of the ideal Bose–Einstein gas. LEIBFRIED, G. *Z. Naturforsch.*, **2a**, 305–10 (*June*, 1947) *In German.*—Schubert [Abstr. 3068 (1946)] cast doubts on the applicability of the saddlepoint method used by Fowler and Jones [Abstr. 107 (1939)] as an approximation for the Bose–Einstein condensation, and even on the validity at low temperatures of the normal form of Bose distribution, on which the calculations of F. London [Abstr. 108 (1939)] have been based. In the present paper it is shown that in spite of the failure of the saddle-point method in the usual sense, the results derived from it remain valid in the sense that the usual Bose formula is correct at all temperatures. H. L.

531.19 : 536.75 : 530.145.6 = 3 *see Abstr.* 2017

531.258 : 538.8 : 535.55 *see Abstr.* 2098

531.259 : 666.1.056.5 *see Abstr.* 2287

531.44 : 536.421.1 2019

Theory of skating. BELL, A. E. *Nature, Lond.*, **161**, 391–2 (*March* 13, 1948).—Some quantitative considerations of the regelation theory are given, which show that an impossibly rapid flow of heat from back to front of the skate blade would be required. It is suggested that plastic flow is responsible for the displacement of ice, and a thin film of water formed by friction lubrication.

531.51 : 530.12 *see Abstr.* 2007–8

531.55 : 621.327.4 : 778.37 *see Abstr.* 2289

MECHANICAL MEASUREMENTS 531.7

531.7 : 621.314.214.4 : 621.317.39.082.744 2(

The linear variable differential transformer. SCHAEVI H. *Proc. Soc. Exp. Stress. Anal.*, **4** (*No.* 2) 79- (1947).—[Abstr. 1939 B (1948)].

531.715.1 : 535.417 = 4 *see Abstr.* 2095

531.717.082.75 : 621.357.7 : 621.317.39.082.75 2(

An electrolytic thickness tester for plated metal coatin FRANCIS, H. T. *J. Electrochem. Soc.*, **93**, 79–83 (*Mar* 1948).—[Abstr. 1729 B (1948)].

531.717.1 : 621.317.49 : 620.198 2(

Measurement of paint film thickness. FANCUTT, AND HUDSON, J. C. *Paint Tech.*, **13**, 49–57 (*Feb.*, 1948) [Abstr. 1632 B (1948)].

531.717.1 : 669.14 : 620.179.15 2(

X-ray thickness gauge for cold rolled strip ste LUNDAHL, W. N. *Elect. Engng, N.Y.*, **67**, 349–53 (*Ap* 1948). See also *Electronics*, **21**, 154, 156, 158, 160, 1 164, 166, 168 (*March*, 1948).—[Abstr. 1627 B (1948)]

531.724 : 535.43 : 535.341 : 539.215.4 2(

Photometric measurement of specific surface. SCO B. A. *Nature, Lond.*, **161**, 358–9 (*March* 6, 1948): In making measurements of light transmission of d persions of fine Al_2O_3 powder, the effective projec area at very small wavelengths was obtained by ext polation; this value is 2× the geometric area [Abstr. 2 (1947)]. The ratio of surface to geometric projected a for rectangular parallelipipeds in random motion 18π $(8 + \pi)$, and use of this factor in computation been found to give reliable results. The effect of abso tiometer acceptance angle on the factor is mentioned.

531.788.13 : 533.7 = 3 *see Abstr.* 2038

531.789.1 : 621.317.39 2(

A capacitance type torquemeter. MILLS, C. H. *J. Sci. Instrum. Phys. Ind.*, **25**, 151–6 (*May*, 1948). The instrument described is intended primarily for t measurement of small dynamic torques of the order 10 lb-ft peak with an accuracy of ±5%. The frequen response is sensibly flat over the range from zero to abo 10 kc/s. The d.c. response enables static measureme to be carried out over short periods not exceeding half hour, the limit being imposed by the zero drift of t instrument. The change of capacitance of the measuri head causes an oscillator to be frequency modulate The frequency modulated signal is passed through limiter stage to eliminate amplitude modulation co ponents present in the signal due to resistance fluctuatio at the slip-rings, by which the gauge connections are mad A simple discriminator, fed from the limiter, is follow by one stage of d.c. amplification whose output is direc coupled to a cathode-ray tube and a high-impedan voltmeter.

MECHANICS OF LIQUIDS 532

532.122 : 532.516 *see Abstr.* 2029

532.13 : 536.22 : 532.7 *see Abstr.* 2033

532.5 = 4 20

Experimental study of the motion of molten metal an open channel. RABINOVITCH, E. Z. *C.R. Acad. S*

SS, **54** (*No.* 3) 201–3 (1946) *In French.*—The problem, ch is important in industrial metallurgy, is to deter- e the velocity distribution of the flow. A method for g this is described, and some results are given showing variation with depth and distance from the centre of velocity in a channel of triangular section. L. S. G.

5 = 4 2027

n formulae for the coefficients of resistance to the ion of molten metal. RABINOVICH, E. Z. *C.R. Acad. URSS*, **54** (*No.* 5) 391–3 (1946) *In French.*—Formulae given which are an improvement on those of Ruff *Metallkde*, **29** (*No.* 7) (1937)]. These were obtained the aid of Bernoulli's equations. L. S. G.

5 : 539.501 2028

ormal stress coefficient in solutions of macromolecules. LIN, R. S. *Nature, Lond.*, **161,** 567–8 (*April* 10, 1948). he normal stress coefficient [Abstr. 541 (1948)] is hly calculated on Kramer's model [Abstr. 2785 6)] for a solution of polystyrene in xylene in steady inar flow. It is shown that it may be of significant ie.

.516 : 532.122 2029

heory of the anelastic fluid. ECKART, C. *Rev. Mod. s.*, **20,** 232–5 (*Jan.*, 1948).—It is shown, by mathe- ic analysis, that in the case of an anelastic fluid, slow dy motions and the diffusion of vorticity obey the ie laws as in the Stokes–Navier theory of a viscous d. Hysteresis is, however, exhibited by the response lensity to pressure. This hysteresis vanishes for very and very high frequencies. The compressibilities for se two limiting cases approach different real values. intermediate values the compressibility is a complex nber, corresponding to the hysteresis. The velocity propagation is also a complex number which is a ction of the frequency. The two roots of this function ermine two relaxation times; one root is associated h the hysteresis, the other with viscosity. J. S. G. T.

.516 : 536.658 : 541.183 *see Abstr.* 2232

.516 : 541.183 *see Abstr.* 2230–1

.517.4 2030

On the law of resistance in the case of turbulent flow ough smooth tubes. KOLMOGOROFF, A. N. *C.R. Acad. URSS*, **52** (*No.* 8) 663–5 (1946).—In place of the l-known type of formula for the coeff. of resistance, ξ, terms of the Reynolds' number (Re) in the case of tur- lent flow in smooth tubes, viz. $1/\xi^{\frac{1}{2}} = A \log (\mathrm{Re}\xi^{\frac{1}{2}}) + B$, Konakov has suggested a formula of the type $1/\xi^{\frac{1}{2}} =$ og Re + B (2), [*C.R. Acad. Sci. URSS*, **51** (*No.* 7) 46)]. The author shows that Konakov's analysis leads t to formula (2) but to formula (1) for large Reynolds' mbers. Deviations from this can occur only when the ue of Re is of the order 1 000s or 10 000s. J. S. G. T.

2.528 2031

Drag in cavitating flow. PLESSETT, M. S., AND SHAFFER, A., JR. *Rev. Mod. Phys.*, **20,** 228–31 (*Jan.*, 1948).— se streamline theory is used to determine the cavity- ag of symmetrical wedges of arbitrary angle, as an tension of Riabouchinsky's theory of the cavity-drag of flat plate [*Proc. Lond. Math. Soc.* (*Ser.* 2) **19,** 206–15 920)]. As an approximation, the pressure distribution r a 2-dimensional wedge is used to calculate the cavity- ag of the corresponding cone of revolution; the result in good agreement with some experimental results of eichardt. J. S. G. T.

2.57 2032

A versatile flowmeter for small rates of liquid flow easily aptable to recording and automatic controlling. DOS- TROVSKY, I., AND LLEWELLYN, D. R. *J. Sci. Instrum. Phys. Ind.*, **25,** 137 (*April*, 1948).

532.57 : 545.71 *see Abstr.* 2237

532.59 : 534.122 *see Abstr.* 2039

CAPILLARITY 532.6

532.6 : 536.423.15 *see Abstr.* 2110

532.613.4 : 541.183 = 4 *see Abstr.* 2233

KINETIC THEORY OF LIQUIDS 532.7

532.7 : 532.13 : 536.22 2033

Coefficients of viscosity and thermal conduction in dense gases and liquids. YANG, L. M. *Nature, Lond.*, **161,** 523–4 (*April* 3, 1948).—These coefficients have been calculated on the basis of Born and Green's theory [Abstr. 2792 (1947)] and are found to have two parts, one due to thermal motion and the other to molecular attraction; the first predominates for dilute gases, the second for liquids. The constants depend on the radial distribution function and its rate of change with density and temperature.

532.7 : 536.48 *see Abstr.* 2112

MECHANICS OF GASES 533

533.15 : 534.231 = 4 2034

Separation by a sound wave of the constituents of a mixture of gases of different masses. PASSAU, P. *Ann. Soc. Sci. Brux.*, **62** (*Sér. I*) 40–6 (*March* 3, 1948) *In French.*—After a short critical account of thermal diffusion and pressure gradient methods, the use of a sound wave is described for producing a pressure gradient in a gas mixture and hence a séparation of the constituents. The theoretical considerations applicable to such a method are outlined, and an apparatus is described which employs a quartz crystal supersonic source for studying mixtures of H_2 and CO_2. The results obtained are in accord with the theoretical predictions, e.g. a 50% H_2 mixture shows greater separation than a 30% mixture. G. F. H.

533.15 : 539.217.5 = 4 2035

The passage of hydrogen through iron. SUTRA, G., AND DARMOIS, E. *C.R. Acad. Sci., Paris*, **226,** 177–9 (*Jan.* 12, 1948) *In French.*—Numerous examples are cited in the literature of H penetrating Fe in the cold, and the present paper discusses experiments for acid solutions. A thin Fe plate had one face in contact with a solution of variable *p*H 3–7 and the other in a vacuum; a table is given showing the loss in weight of the Fe, the total H_2 generated and the amount diffused. From the data, it is concluded that the diffused H is of atomic origin. In a previous note the authors have stated that the H ion in water was very probably a naked proton and not the hydrated ion; they now submit a comprehensive argument based on their experimental data that protons pass directly from the solution into the metal. H. H. HO.

533.5 : 621.384 : 545.7 *see Abstr.* 2235

533.5 : 621.385.032.46 = 4 2036

The evolution of pumping connections for electron tubes. MARTIN, J. *Le Vide*, **2,** 308–18 (*July-Sept.*, 1947) *In French.*—The disadvantages of the ordinary glass tube seal-off for large diameters are stressed. Experimental seal-off methods in which metal plates are sealed to the end of glass tubes or into glass throats by h.f. heating under vacuum are detailed. The best technique is to use a metal tube, glassed at the end, to seal to a glassed metal

plate. The metal plate is held out of the pumping line by an electromagnet until the moment of seal-off. Methods using Ni–Fe and Cu tube pumping connections are described. A. H. W. B.

533.6.01 : 541.182.2/.3 = 3 2037

An extension of the flow and continuity equations of a moving gas to include the existence of gas sources and the entrainment of solid or fluid particles. Cap, F. *Acta Phys. Austriaca*, **1** (*No.* 1) 89–97 (1947) *In German.*—Equations for the 1-dimensional flow of gases are extended to allow for the presence of "gas sources," also combustible liquid droplets and solid particles. General methods of solution are outlined. Results may have some application to theories of rocket propulsion and internal ballistics. T. S. E. T.

KINETIC THEORY OF GASES 533.7

533.7 : 531.788.13 = 3 2038

Investigations on the influence of the accommodation coefficient on radiometric phenomena and molecular manometers. Weber, S. *K. Danske. Vidensk. Selsk. Mat.-fys. Medd.*, **24** (*No.* 4) 59 *pp.* (1947) *In German.*—From the formula derived previously by the author [*K. Danske. Vidensk. Selsk. Mat.-fys. Medd.*, **14** (*No.* 13) (1937)] for the radiometric force/cm², K, in the Knudsen absolute manometer, in which the effect of the accommodation coefficient, a, was neglected, it follows that, for the same apparatus and pressure, K for two gases with the same mean free path, λ, should be the same. Fredlund [Abstr. 586 (1944)] has shown experimentally with his molecular manometer this is not so for H_2 and D_2; for $d/\lambda \to 0$, the K's are practically the same, but for $d/\lambda \to \infty$ K for $H_2 \simeq 2\times$ that for D_2, where d is the controlling factor of the radiometer system. The effect of a is now investigated theoretically for both the Knudsen and Fredlund manometers and fresh formulae derived. For the Knudsen manometer, the effect of a cannot be neglected for $d/\lambda \to \infty$. Fredlund's results are verified, as also the relation between K and pressure. Klumb and Schwarz's absolute manometer [Abstr. 1445 (1948)] is described, and K for a disc held between two large parallel plates at temperatures T_1 and T_2 is calculated. Knudsen's manometer for $d/\lambda \to 0$ is considered, and it is shown that $K = \frac{1}{4}(p/T)(T_1 - T_2)/(1 + \alpha pd/\lambda)$ where $(T_1 - T_2)/T \ll 1$ and $\alpha \simeq 0{\cdot}43$. From Fredlund's observations $\alpha \simeq 2\times$ this value. An explanation of this discrepancy is given in terms of the effective cross-sections of the molecules. S. W.

VIBRATIONS . ACOUSTICS 534

534.122 : 532.59 2039

Acoustic treatment of liquids in thin laminae. Horsley, C. B., Jones, R. C., and Smith, A. A. *J. Acoust. Soc. Amer.*, **20**, 182–5 (*March*, 1948).—Very large amplitudes of the velocity and acceleration produced by a sound wave in water may be evoked by exposing thin laminae of the liquid to an airborne sound wave. In the case of water and air at atm. pressure and at a frequency of 10 kc/s, the power advantage is shown to be a factor of about 3 600 when the thickness of the lamina is small compared with 14 microns. On the other hand, the use of liquid laminae is ineffective when the effects desired depend on the pressure amplitude of the sound wave, as distinct from the velocity or acceleration. Sketches of an experimental arrangement are shown. A.

534.222 : 534.845 *see Abstr.* 2053

534.222.1 2(

Compressional wave front propagation through a sim vortex. Lindsay, R. B. *J. Acoust. Soc. Amer.*, 89–94 (*March*, 1948).—The equations of propagation a compressional wave through a moving medium developed in vector notation. Application is made to special case of a linear vortex of constant strength m which the motion is irrotational. Differential equatic are set up in general form for the wave fronts and ra A simple approximation is derived for the distorti produced in an originally plane wave front by tra mission through the vortex. The results are in gene agreement with observed fluctuation phenomena acoustic propagation in air.

534.231 : 533.15 = 4 *see Abstr.* 2034

534.232 = 5 20

Directional characteristic of a cylindrical acous radiator with a conical reflector. Bacchi, G. *A Frequenza*, **17**, 74–8 (*April*, 1948) *In Italian.*—A form cylindrical magnetostriction radiator with a coni reflector arranged on its axis has a directional chara teristic with an absolute max. on the axis. The wa lengths used are of the same order as the dimensions the radiator. If the reflector has a 45° opening t characteristic is represented by the integral of the zer order Bessel function.

534.321.9 20

A study of ultrasonic velocity and absorption in liq mixtures. Burton, C. J. *J. Acoust. Soc. Amer.*, 186–99 (*March*, 1948).—The absorption and velocity sound in binary mixtures of water with alcohols, glyco and glycol ethers have been measured at frequencies the range of 5–25 Mc/s, using the optical diffracti method originally developed by Debye, Sears, Lucas, a Biquard. The method of absorption measurement w improved by utilization of a high gain, seconda multiplier-type photo-tube viewing the first-order diffra tion spectrum, the change in intensity of this spectru being an index of the sound absorption in the liqu Ultrasonic absorption peaks at intermediate concentr tions were found in mixtures containing acetone, ethan propanol, isopropanol, and tertiary butanol and in t monoethyl and monobutyl glycol ethers. No absorpti peaks were found in mixtures containing methan glycol, monomethyl glycol ether, or dioxane. Veloci peaks at intermediate concentrations were found in of the mixtures listed. Mixtures of tertiary butanol a methanol show neither absorption nor velocity peal The observed absorptions are considerably greater th would be expected from classical theory.

534.321.9 : 534.614 *see Abstr.* 2045

534.321.9 : 548.0 *see Abstr.* 2243

534.321.9 : 615.83 = 3 *see Abstr.* 2286

534.41 20

The analysis of acoustic signals by means of the se consistent spectrum. Markham, J. J. *J. Acoust. Sc Amer.*, **20**, 95–8 (*March*, 1948).—The problem analysing the spectrum of acoustic signals is discussed f various types of filters. The problem is straightforwa for narrow band-pass filters but requires, in general, self-consistent assumption for broad filters. The nece sary assumption is made, and two examples are given.

534.413 = 4 20

Sensitive flames and jets. Dubois, M. *C.R. Acad. Sc Paris*, **226**, 164–6 (*Jan.* 12, 1948) *In French.*—Aft reviewing the work of Tyndall, Raleigh, Govi, Bou Charron and Bouasse, the author criticizes the results G. B. Brown. He disagrees with the latter's suggesti

there is an upper limit of frequency response. He onstrates the effects of varying the diameter of the and the velocity of the gas stream. The smaller the neter of the jet, the higher the frequency to which it respond, provided the velocity is adjusted appro- tely. The smallness in the diameter of tubes at the her frequencies introduces difficulties of observation. ntually the author used a jet of H_2 crossing a gauze n away from the jet, the flame being lighted above the ze. This arrangement, known as Rayleigh's sensitive ne, provides jets 0·5 mm diameter sensitive up to a quency of 23 kc/s with a jet velocity ~ 9 000 cm/sec. A. B. W.

.414 : 612.858.71 *see Abstr.* 2285

.614 : 534.321.9 2045

Ultrasonic dispersion in organic liquids. SCHALLAMACH, *Nature, Lond.*, **161,** 476 (*March* 27, 1948).—Measure- nts of velocity of sound of frequencies between 700 and 00 kc/s at temps. between +15 and −80°c in 3 organic uids were made. Evidence of both positive and ative dispersion was found.

.641 2046

Acoustic impedance from motional impedance diagrams. Y, R. D., AND WHITE, J. E. *J. Acoust. Soc. Amer.*, **20,** -107 (*March*, 1948).—When an acoustic load is upled to an electromagnetic transducer through a gth of air column, there is a critical length at which an crement in acoustic load produces a max. increment in ctrical impedance. The method utilizes this critical upling to obtain an optimum precision in determining acoustical impedance. It is noteworthy that the value the characteristic impedance of the air column is not sumed but is directly measured. A.

.75 2047

The atonal interval. POLLACK, I. *J. Acoust. Soc. mer.*, **20,** 146-9 (*March*, 1948).—Thresholds for the tection of the presence of a sinusoidal signal (thresholds audibility) and thresholds for the perception of the nal character of the signal (thresholds of tonality) were termined for 3 listeners over a wide range of audible equencies. At each of the frequencies tested, the reshold of audibility was found to be significantly wer than that of tonality. The difference between the wo—the atonal interval—ranged from about 2·5 db at 00 c/s to about 6·5 db at 4 000 c/s. Little difference as found between the variabilities of the two thresholds. reliminary measurements indicated that acuity of equency discrimination changes quite abruptly at the reshold of tonality. Below the threshold of tonality, requency discrimination is very poor; above it, frequency iscrimination is markedly more acute. A.

34.75 : 612.858.7 *see Abstr.* 2282

34.76 : 621.395.616 2048

A condenser-microphone for stereophony. RADEMAKERS, A. *Philips Tech. Rev.*, **9** (*No.* 11) 330-8 (1947-48).—[Abstr. 1805 B (1948)].

534.773 2049

A cavity pressure method for measuring the gain of hearing aids. CORLISS, E. L. R., AND COOK, G. S. *J. Acoust. Soc. Amer.*, **20,** 131-6 (*March*, 1948).—The method requires no dead room, thus allowing a compact set-up. The validity of the method and the avoidance of diffraction effects are studied. Comparisons with free field data are made. The applicability of results to the specification of gain characteristics for hearing aids is discussed. A.

534.78 : 621.395.8 2050

Speech communication under conditions of deafness or loud noise. RADLEY, W. G. *J. Instn Elect. Engrs, Pt I,* 95, 201-16 (*May*, 1948).—[Abstr. 2026 B (1948)].

534.83 2051

Acoustical characteristics of noise produced by snapping shrimp. EVEREST, F. A., YOUNG, R. W., AND JOHNSON, M. W. *J. Acoust. Soc. Amer.*, **20,** 137-42 (*March*, 1948).

534.833 2052

A sheet of air bubbles as an acoustic screen for underwater noise. LOYE, D. P., AND ARNDT, W. F. *J. Acoust. Soc. Amer.*, **20,** 143-5 (*March*, 1948).—The air bubble screen described was developed to provide an acoustic barrier across the end of a dock so as to enable noise measurements on submarines to be carried out inside the dock free from external underwater interference. A.

534.845 : 534.222 2053

Absorption and scattering for impedance boundary conditions on spheres and circular cylinders. LAX, M., AND FESHBACH, H. *J. Acoust. Soc. Amer.*, **20,** 108-24 (*March*, 1948).—The phase shift analysis is applied to the absorption and scattering of plane waves by spherical and circular cylinder regions. The boundary condition on the surface of these regions is expressed in terms of an impedance. A method of calculating the required phase shifts and corresponding scattering and absorption cross-sections is given with the necessary tables. When the reactive part of the impedance is capacitative, resonance phenomena can occur. Approx. cross-sections for low and high frequencies are given. It is shown that at low frequencies, acoustic treatment of scattering surfaces will, in general, increase the scattering and, therefore, their ability to increase the diffusion of sound in a room. A.

534.85 : 621.317.39 2054

Wow meter for turntable testing. SANSBURY, G. L., AND PAPPENFUS, E. W. *Electronics*, **21,** 108-11 (*March*, 1948).—[Abstr. 1726 B (1948)].

534.864.2 : 621.395.623.7 2055

A proposed loudness-efficiency rating for loudspeakers and the determination of system power requirements for enclosures. HOPKINS, H. F., AND SKRYKER, N. R. *Proc. Inst. Radio Engrs, N.Y.*, **36,** 315-35 (*March*, 1948).—[Abstr. 1806 B (1948)].

OPTICS . RADIATION . SPECTRA 535

535.241 = 82 2056

Theory of the light field. GERSHUN, A. A. *Elektrichestvo* (*No.* 10) 5-11 (1947) *In Russian.*—After a historical survey of theoretical photometry a general theory of the light field is postulated. The conceptions of light ray brightness (Planck) identical in vacuum with Lambert's, of intensity of radiating area unit, of spatial illumination, which is the scalar integral of the above taken in 3 dimensions, and of the vector of the light flux density D, of which any projection = the difference of illumination on to the two sides of a surface element normal to the projection direction, are discussed in detail, and it is shown that in vacuum div $D = 0$. A general mathematical theory based on the above units is developed, and some applications are described. A. L.

535.243 : 518.3 2057

Nomographs for spectral band width of the Beckman DU spectrophotometer. HAENDLER, H. M. *J. Opt. Soc. Amer.*, **38,** 417-19 (*April*, 1948).

535.245.2 : 551.521 : 771.376.2 *see Abstr.* 2288

535.312 : 535.66 *see Abstr.* 2100

535.312/.314 = 4 2058

Reflecting and refracting systems. Reflections and refractions produced by an arbitrary system of plane surfaces. KAŠPAR, E. *Rev. Opt. (Théor. Instrum.)* **27,**

15–28 (*Jan.*, 1948) *In French.*—Incident and refracted rays and surface normals are represented by unit vectors, the laws of reflection and refraction then taking the form of vector products. The final ray after a number of successive reflections or refractions (or combination of these two) is then given as a vector expressed as a determinant. H. H. HOP.

535.313 = 4 2059

On the improvement of the visual performance of the reflecting telescope. PAUL, M. *Rev. Opt.* (*Théor. Instrum.*) **27**, 93–9 (*Feb.*, 1948) *In French.*—A general consideration of the 3rd-order aberrations of a plate-mirror-plate system. Particular cases are dealt with which give aplanatic systems with greatly reduced astigmatism. H. H. HOP.

535.313 : 535.822 : 539.17 *see Abstr.* 2195

535.314 : 548.734.3 *see Abstr.* 2257

535.315 + 535.421 = 3 *see Abstr.* 2096

535.315 : 681.4 2060

Electroformed precision prisms. GOLDBERG, B. *J. Opt. Soc. Amer.*, **38**, 409–12 (*April*, 1948).—Describes an investigation for electroforming metal trihedral prisms with reflecting surfaces that approach the optical accuracy of commercial trihedral glass prisms. The metal prisms were tested and compared with glass prisms. The optical response of the best of the metal retro-directive reflectors at a distance of 1 mile was $\sim\frac{1}{3}$ that of a commercially produced glass prism having an optically-active area $\sim 3\times$ the area of the metal prism. The metal prism, although about as accurate as a commercially produced glass prism at a distance of one mile, is still not as accurate as its mould. Metal retro-directive reflectors produced by electroforming would cost $\sim\frac{1}{8}$ as much as a commercially produced glass prism of the same optical accuracy. A.

535.317 : 621.397.62 2061

TV lens considerations for image orthicon cameras. MAUTNER, L. A. *Communications*, **28**, 14–16, 28–9 (*Jan.*, 1948).—[Abstr. 1849 B (1948)].

535.317.2 2062

Centering of optical systems. INGALLS, A. L., AND PESTRECOV, K. *J. Opt. Soc. Amer.*, **38**, 343–9 (*April*, 1948).—An auto-collimation method has been developed whereby the centring of component surfaces within an optical system may be measured. Paraxial transfer formulae containing a quantity called eccentricity are developed after definitions have been promulgated for certain terms. For a given optical system, the position, with respect to a reference axis, of an image due to reflection from an optical surface within the system depends on (*a*) the distance of the object from the reference axis, (*b*) the magnification of the reflecting and refracting surfaces involved and (*c*) the eccentricities of each surface. If all other factors are known, the eccentricity of each surface may be computed from measurements of the displacement of the auto-collimated image. A.

535.317.2 2063

Performance of an optical system as the sum of the contributions of its construction elements. HERZBERGER, M. *J. Opt. Soc. Amer.*, **38**, 324–8 (*April*, 1948).—A simple formula given shows how the diapoint deviations for an optical image can be considered as the sum of errors originating at the single surfaces. In this way, and with the help of a series of diagrams, the lens designer can obtain an accurate picture of the effect of the single surface on all the rays traversing the optical system. Diagrams for two photographic lenses included.

535.32 : 548.0 2

The dispersion formulae of the alkali halides. R HAKRISHNAN, T. *Proc. Indian Acad. Sci. A*, **27**, 165 (*Feb.*, 1948).—Utilizing latest data on dispersion absorption, dispersion formulae of the Drude type h been worked out for LiF, NaF, KF, NaCl, KCl, Rb KBr, RbBr, KI and RbI. W. R

535.321 : 535.341 : 535.51 2

The determination of the optical properties of opa isotropic substances. WOOSTER, W. A. *J. Sci. Instr Phys. Ind.*, **25**, 170–4 (*May*, 1948).—A spectrome fitted with polarizer, quarter-wave plate, analyser an photocell is described. Two methods may be emplo for determining the refractive and absorption indices an isotropic opaque substance. One involves measurement of the intensities of the two polari components of the light reflected from the surface, a the other the measurement of two angles known as t principal angle of incidence and the principal angle azimuth respectively. Examples are given of the appli tion of this method to the study of the optical proper of some opaque substances.

535.321 : 535.417 : 535.822.9 *see Abstr.* 2103

535.33.03 20

A low voltage source of ultra-violet continuu ROTHFELS, H. J. *J. Sci. Instrum. Phys. Ind.*, **25**, 1 (*May*, 1948).—A hydrogen discharge tube is describe It operates off 100 V d.c. and does not require spec cooling or a separate gas reservoir.

535.33.072 = 3 20

On the adjustment of the curvature of spectral lines a constant slit curvature. VON KEUSSLER, V. *Z. Astr phys.*, **24** (*Nos* 3–4) 252–62 (1948) *In German.*—It shown how a line of given curvature can be obtained a suitable choice of slit curvature and geometric conditions in prism and grating spectrometers. A.

535.33.072 : 522.56 = 3 20

On the curvature of spectral lines in grating- and prism spectra. VON KEUSSLER, V. *Z. Astrophys.*, **24** (*Nos* 3–4 230–46 (1948) *In German.*—Detailed analytical treatmer of line curvature. Practical application to the cor struction of spectroheliograph slits. A.

535.338.1 : 535.343.4 : 536.46 206

The infra-red emission and absorption of the carbo monoxide-oxygen flame. SILVERMAN, S., HORNBECK G. A., AND HERMAN, R. C. *J. Chem. Phys.*, **16**, 155– (*Feb.*, 1948).—A preliminary report. The flame showe weak bands near 667 and 721 cm^{-1} in emission an absorption. The emission is compared with that fron CO_2 at 1 400°K. A. G. G

535.338.1 : 536.46 207

Infrared radiation from a Bunsen flame. PLYLER, E. K *J. Res. Nat. Bur. Stand., Wash.*, **40**, 113–20 (*Feb.*, 1948).— The emission spectrum was studied from 1 to 24 μ; im proved resolution of known bands and occurrence of weak new bands is reported. Fine structure between 2·8 and 3·1 μ is attributed to H_2O rather than to OH. Lines of the pure rotation spectrum of H_2O occur between 12 and 24 μ. The CO_2 emission band at 15 μ was obtained. Approximate estimates of the intensities of the 4·36 and 15 μ bands indicate that they are roughly in the ratio of the transition probabilities. A. G. G.

535.338.3 = 4 2071

Appearance of the resonance line 2 537 A in the diffuse spectrum of mercury vapour. LENNUIER, R. *C.R.*

l. Sci., Paris, **225**, 928–30 (*Nov.* 17, 1947) *In French.*—ditions for the excitation of the resonance line are ssed. This line does not originate through spectral dening owing to Doppler effect nor to broadening ugh collisions. W. R. A.

338.332 ; 539.153 2072

ructure of the ionized helium line λ1640. Fowles, *Phys. Rev.*, **73**, 639 (*March* 15, 1948).—Three lines been resolved. The separation of the two stronger $\cdot 154 \pm 0 \cdot 024\ cm^{-1}$. The shift in the $2^2S_{\frac{1}{2}}$ level is much larger than that found in the $3^2S_{\frac{1}{2}}$ level. str. 700 (1948)]. R. F. B.

338.334 : 535.343.4–14 *see Abstr.* 2076

338.4 2073

ew bands in the Schumann–Runge system of the gen molecule. Lalji Lal. *Nature, Lond.*, **161**, 477–8 *rch* 27, 1948).

.338.4 : 539.152.1 *see Abstr.* 2171

339.1–31 = 4 2074

ew monochromator for the near ultra-violet. Atanasiu, *Bull. Soc. Roumaine Phys.*, **46** (*No.* 83) 17–25 (1945) *French.*—A new constant deviation monochromator of h aperture has been devised for the spectral range 00–2 000 Å. It is of Wadsworth type, with total-ection prism, the whole optics being of crystal quartz. calculating the total-reflection prism birefringence, it roved that the divergence of the polarized rays, within working conditions, is small enough to permit satis-tory use for research work. The same apparatus, vided with fused quartz optics, is very convenient for reduced spectral region limited at $\lambda > 2\ 700$ Å. A.

5.34 : 537.531 : 545.824 *see Abstr.* 2240

5.341 : 535.51 : 535.321 *see Abstr.* 2065

5.341 : 539.215.4 : 535.43 : 531.724 *see Abstr.* 2024

5.343 : 523.841.1 = 3 *see Abstr.* 1993

5.343.4 = 4 2075

On the absorption spectrum of Br_2 vapour. Agârceanu, I. *Bull. Soc. Roumaine Phys.*, **46** (*No.* 83) 3–7 945) *In French.*—The absorption lines, observed and otographed on the continuous background of the 769 and 5 790 Hg lines, spread and unite as the Br_2 pour pressure increases. At 30°c they lose their dividuality, and become a continuous absorption ckground. A comparison with I_2 absorption lines ggests that the $^3\Pi_{0_g^-}$ component has a stronger action the $^3\Pi_{0_u^+}$ in Br_2 than in I_2 vapour. It also explains . W. Wood's experiments on the Br_2 fluorescence. A.

35.343.4 : 536.46 : 535.338.1 *see Abstr.* 2069

35.343.4–14 : 535.338.334 2076

Collision broadening of the ammonia inversion spectrum t high pressures. Bleaney, B., and Loubser, J. H. N. *ature, Lond.*, **161**, 522–3 (*April* 3, 1948).—Earlier easurements on lines in the frequency range 0·1–·2 cm^{-1} [Abstr. 2105 (1947)] have been extended up to atmos. by observations on the damping of a H_1 cavity esonator. A formula with constants determined mpirically at each pressure is found to describe the bsorption at high pressure, where the fine structure isappears. The variation of the constants with pressure s discussed; above 2 atmos. the collision frequency no onger increases linearly with the pressure, and this is scribed to double collisions. At the same time, the verage resonant frequency falls to zero, representing the estruction of the inversion of the molecule, either due o the mean time between collisions becoming < the natural period of inversion, or to the strong fluctuating lectric field of surrounding dipoles.

535.343.4–14 : 539.13 2077

Second-order corrections to quadrupole effects in molecules. Bardeen, J., and Townes, C. H. *Phys. Rev.*, **73**, 627–9 (*March* 15); errata, 1204 (*May* 15, 1948).—Measurements of the hyperfine structure of the $J = 3 \rightarrow 4$ transition of ICN for $v'' = 0$ and 1 are reported. Discrepancies between the results and the theoretical predictions of Casimir are largely accounted for by 2nd-order effects arising from quadrupole interaction of different rotational levels. Expressions are given for the matrix elements applicable to linear and symmetric top molecules. Small residual discrepancies, ~ 1 Mc/s, may be real. R. F. B.

535.343.4–14 : 539.13 2078

Nuclear quadrupole coupling of nitrogen in ICN and N_2O. Smith, A. G., Ring, H., Smith, W. V., and Gordy, W. *Phys. Rev.*, **73**, 633 (*March* 15, 1948).—Hyperfine structure due to N in the $J = 3 \rightarrow 4$ transition of $IC^{12}N^{14}$ has been resolved and interpreted with the aid of the first-order theory of Bardeen and Townes [Abstr. 1296 (1948)]. The nuclear quadrupole coupling of the N is $-3 \cdot 80$ Mc/s: for I the corresponding value is $-2\ 540 \pm 25$. Measurements on the $J = 0 \rightarrow 1$ transition of $N^{14}N^{14}O$ lead to a value of the quadrupole coupling of N^{14}— in the end position of $-1 \cdot 03 \pm 0 \cdot 10$ Mc/s, using $-0 \cdot 27$ Mc/s for the central N. R. F. B.

535.343.4–14 : 539.13 2079

Anomalies in the hyperfine structure of CH_3I and ICN. Gilliam, O. R., Edwards, H. D., and Gordy, W. *Phys. Rev.*, **73**, 635–6 (*March* 15, 1948).—Some lines in the $J = 2 \rightarrow 3$ transition of CH_3I, expected from the first-order theory to be degenerate, are in fact resolved. Moreover, appreciable nuclear interaction is observed for the term $J = 3$, $K = 2$. Another anomaly is noted in the $J = 7 \rightarrow 8$ transition of ICN, where values of the nuclear quadrupole coupling of I range from $-2\ 388$ Mc/s, calculated from $F_1 \rightarrow F_1 + 1 = \frac{9}{2} \rightarrow \frac{11}{2}$, to $-2\ 563$ Mc/s for $\frac{15}{2} \rightarrow \frac{17}{2}$. R. F. B.

535.343.4–15 = 4 2080

The infra-red absorption of methylene chloride vapour. Bârcă-Gălăteanu, D. *Bull. Soc. Roumaine Phys.*, **46** (*No.* 83) 9–16 (1945) *In French.*—The absorption in the regions 3 μ and 6·15 μ was investigated. The 3 000 cm^{-1} region contains the two characteristic valency-vibrations of the CH_2 group at 3 032 and 2 990 cm^{-1}. In this same region was found a third very intense band at 3 006 cm^{-1}, ascribed to the first harmonic of the CH_2 groups deformatory vibration. In the 6–15 μ interval there are two very intense absorption regions at 8 μ and 13 μ. The band at 772 cm^{-1} is believed to be one of the fundamentals; according to computation this is to be expected between 843 and 720 cm^{-1}. The 8 μ band has been resolved into 3 components: 7·830, 7·905 and 8·187 cm^{-1}. The first and the last one are ascribed to combination bands and 7·905 to a fundamental vibration. In all, 13 new bands are detected. It is concluded that the aliphatic hydrocarbon molecules which contain the CH_2 group have three intense bands in the 3 000 cm^{-1} region. A.

535.343.4–15 : 545.82 *see Abstr.* 2238

535.343.4–15 : 551.521.3 2081

Transmission of the atmosphere in the 1–5 micron region. Elliott, A., and MacNeice, G. G. *Nature, Lond.*, **161**, 516 (*April* 3, 1948).—An absorption spectrum is shown, obtained using a 600-yd absorbing path, a Littrow quartz-prism spectrometer and a thermopile detector. A region of high transmission exists between 3 and 4 μ, reaching 95% over a band at least ½ μ broad.

535.343.4–32 2082

Absorption band spectrum of S_2 in the Schumann region. MAEDER, R., AND MIESCHER, E. *Nature, Lond.*, **161**, 393 (*March* 13, 1948).—The bands between 1 600 and 1 900 Å were investigated with a 1 m vacuum grating spectrograph, and a brief analysis of the results is given.

535.343.4–32 = 4 2083

Absorption spectrum of HCl vapour in the Schumann region. ROMAND, J., AND VODAR, B. *C.R. Acad. Sci., Paris*, **226**, 238–40 (*Jan.* 19, 1948) *In French.*—Curves of the extinction coefficient, K_N, in the range 2 100–1 350 Å are given. The maximum absorption is at about 1 535 Å with $K_N \simeq 40$ (for 1 cm at 0°C, 760 mm). R. F. B.

535.345.1 : 541.5/.6 *see Abstr.* 2234

535.35 : 535.372 = 4 *see Abstr.* 2091

535.37 2084

The temperature dependence of the fluorescence of tungstates and molybdates in relation to the perfection of the lattice. KRÖGER, F. A. *Philips Res. Rep.*, **2**, 340–8 (*Oct.*, 1947).—Tungstates of Ca, Cd and Mg, and $CaMoO_4$, crystallized at varied temperatures, were examined for X-ray diffraction patterns, and for the spectral distribution and temperature-dependence of their photoluminescence. The temp. range in which luminescence decreases rapidly is generally shifted to higher temp. as the temp. of initial heat treatment is increased; this is attributed to greater perfection rather than to increased grain size in the crystals. Theories of dissipation of excitation energy in phosphors are briefly considered. S. T. H.

535.37 : 537.312.5 2085

Relation between photoconduction and luminescence in zinc sulphide. WILKINS, M. H. F., AND GARLICK, G. F. J. *Nature, Lond.*, **161**, 565–6 (*April* 10, 1948).—Experiments are reported which indicate that luminescence centres and traps may co-exist in one centre, and that excited electrons may be raised to a trap level in this centre without being free to travel through the crystal. The photo-conductivity of ZnS–Cu may be simply due to a limited displacement of the electrons within the centre.

535.371 2086

Luminescence efficiency changes in zinc sulphide phosphors below room temperature. GARLICK, G. F. J., AND GIBSON, A. F. *Nature, Lond.*, **161**, 359 (*March* 6, 1948).—Measurements were made of the efficiency of luminescence excitation at various wavelengths, and the resulting graph shows a peak which moves towards longer wavelength as temperature is raised. This explains the slow variation of efficiency with temp. at sub-quenching temps., which is positive for long wavelengths and negative for short; Williams and Eyring's theory [Abstr. 2106 (1947)] cannot account for the latter. The shift of excitation peak with temp. is shown to be the same as the absorption edge shift in these phosphor types.

535.371.07 : 537.531 : 621.386.832 2087

The light-emission of X-ray screens. KLASENS, H. A., AND DE GROOT, W. *Philips Tech. Rev.*, **9** (*No.* 11) 321–9 (1947–48).—Reviews the various ways in which fluorescent screens are employed in radiography. Factors determining the brightness of a viewing screen or the darkening of a photographic image obtained with the aid of an intensifying screen are discussed, namely, (1) the absorption of X-rays in the screen; (2) the conversion of absorbed X-ray energy into energy of fast electrons formed in the mass of the screen; (3) the conversion of the electron energy into light energy or photographically active radiation: (4) the absorption and the scattering light in the screen; (5) the selectivity of the eye or of photographic emulsion relative to the spectral distribution of the radiated fluorescent light. The optimum thickness for viewing and intensifying screens and most suitable luminophores are investigated. It is shown that for intensifying purposes, when using low to voltages (<70 kV), ZnS screens are preferable to CaW screens.

535.371.07 : 621.385.832 2

Performance characteristics of long-persistence cathode ray tube screens; their measurement and control. JOHNSON, R. E., AND HARDY, A. E. *RCA Rev.*, **8**, 660–81 (*Dec.* 1947).—[Abstr. 1998 B (1948)].

535.371.07 : 778.333 2

Fluorescence of highly insulating dielectrics produced by X- and γ-radiations. WILSON, C. W. *Nature, Lond.*, **1** 520–1 (*April* 3, 1948).—Certain light-atom insulating materials, particularly "Distrene" (polystyrene), g visible and possibly u.v. fluorescent emission wh irradiated with X-rays (60–200 kV peak) and Ra γ-ra The use of this phenomenon for non-absorbing intensi ing screens, independent of wavelength, for dose measu ment is suggested.

535.372 2

Fluorescence of solid acetone. KASKAN, W. E., A DUNCAN, A. B. F. *J. Chem. Phys.*, **16**, 223–4 (*Mar* 1948).—The weak blue fluorescence of acetone vapo illuminated by wavelength 3 130 Å, was found to intensified in the solid state at 83°K. A broad unresolv spectrum in the region 4 000–5 000 Å was obtained. T lifetime of the fluorescence was found to be $\sim 10^{-3}$ s C.

535.372 : 535.35 = 4 2

Phosphorescence of sodium vapour in a rare gas atm sphere. AYNARD, R., AND HERMAN, L. *C.R. Acad. Sc. Paris*, **225**, 932–4 (*Nov.* 17, 1947) *In French.*—T behaviour of a Na discharge lamp containing traces Ne and A in the cold and at higher temp. has be investigated. The spectrum obtained in the cold reve lines of Ne I and A I whilst in the phosphorescen spectrum there is practically no trace of the Ne I lin Working the lamp hot, the yellow doublet is extreme intense, the $2P$–nD series is represented by the 5 683–88 doublet, and the more intense lines of Ne I appear. T hot vapour does not exhibit phosphorescence of lo duration and a special technique for determining t phosphorescence spectrum is outlined. This spectru shows a remarkable development of the high terms the series $2P$–nD. The results of these experiments a discussed in relation to the origin of Na lines in t radiation of the upper atmosphere and two possibilities excitation ((*a*) by electronic collision; (*b*) by ion recombination) are distinguished. W. R.

535.375.5 : 548.0 = 4 2

Raman effect in a monocrystal of Seignette salt polarised light at ordinary temperature. CHAPELLE, *C.R. Acad. Sci., Paris*, **226**, 401–3 (*Feb.* 2, 1948) *French.*—A single crystal of $KNaC_4H_4O_6\ 4H_2O$ w examined, with special reference to the O–H vibratio arising from the water of crystallization and from t tartaric ion. A very wide band was found at 3 400 200 cm^{-1} with natural exciting light. On this band a superposed (*a*) narrow bands with centres at 3 40 3 478, 3 537 cm^{-1}, (*b*) wide bands at 3 277 ± 25 an (weak) at 3 300, and a band from 3 400 to 3 540 cm^{-} Tensors are given which represent the intensities of t bands found experimentally depending on directions

rization and observation. The intensity tensors are ilated assuming the orthorhombic structure (V^3) of salt, and it is assumed that the water has the same metry as in the vapour. 3 407 and 3 478 can be buted to vibrations of a molecule of water with a t H bond. 3 277 is attributed to the tartrate ion. other bands are too ill-defined to be interpreted.

A. C. M.

39 = 4 2093

n the reflection and transmission of a plane wave by bsorbing plate. ABELÈS, F. *C.R. Acad. Sci., Paris*, 1297–8 (*Dec.* 22, 1947) *In French.*

417 : 523.91 2094

he behavior of an interferometer in a gravitational . II. Application to a planetary orbit. IVES, H. E. *Opt. Soc. Amer.*, **38**, 413–16 (*April*, 1948).—[See Abstr. 2 (1939)]. The assumption of identity of properties of ody stationary in a gravitational field and of a body ng under an inverse square law of attraction, pre- asly used to account for optical phenomena, is applied dynamical phenomena by the extension of the same umption to mass. Force equations corresponding to gravitational mass $m_0/(\gamma - r^2/c^2\gamma - r^2\dot{\theta}^2/c^2)^{\frac{1}{2}}$ are ived, which when solved for a planetary orbit, give the erved advance of perihelion of Mercury. A.

.417 : 531.715.1 = 4 2095

Applications of thallium and zinc spectral lines in trology. PÉRARD, A. *C.R. Acad. Sci., Paris*, **225**, 5–7 (*Dec.* 1, 1947) *In French.*—In metrology the direct servation is the fractional excess of an order of inter- ence, and the whole number is deduced by combining servations of the excess fraction given by several ectral lines. This assumes that the wavelengths of the es are constants, independent of the path. This is only ictly true for monochromatic lines. By comparison th a sufficiently monochromatic line (e.g. Cd red), it is ssible to evaluate corrections for lines less mono- romatic, which can be added to the fractional excesses served. Working in this way, with a Michelson inter- ometer, complex lines were studied in Cs, Tl and Zn ctra, chosen because of their brightness. In graphs, rrections are given for the green Tl line (5 350 Å) and red (6 363 Å) and blue (4 811 Å) Zn lines, as functions the path difference up to 200 mm. This allows these ore intense sources to be used in spite of the lines not ing strictly monochromatic. A. C. M.

5.417 : 535.321 : 535.822.9 *see Abstr.* 2103

5.421 + 535.315 = 3 2096

On the geometrical conditions for refraction through a ism and diffraction through a grating. VON KEUSSLER, V. *Astrophys.*, **24** (*Nos* 3–4) 247–51 (1948) *In German.*—eometrical constructions for the light paths through isms and gratings are given, and an extension for lenses indicated. A. B.

5.43 : 535.341 : 539.215.4 : 531.724 *see Abstr.* 2024

5.43 : 537.531] + 548.736.442 *see Abstr.* 2262

5.51 : 535.341 : 535.321 *see Abstr.* 2065

35.542.1 : 535.55 2097

A large field compensator for measurement of bire- ingence. JELLYMAN, P. E., AND MILNE, A. J. *Nature, ond.*, **161**, 477 (*March* 27); WELLS, A. A., *Ibid.*, 602 *April* 17, 1948).

35.55 : 535.542.1 *see Abstr.* 2097

35.55 : 535.8 : 531.258 2098

The optical system in photoelastic observations. JESSOP, I. T. *J. Sci. Instrum. Phys. Ind.*, **25**, 124–6 (*April*, 1948).—The conditions necessary in order that a projected fringe-pattern shall provide an accurate representation of the stress-distribution in a parallel plate model are considered. These conditions are shown to be most efficiently fulfilled (1) by employing a comparatively large source of light and cutting down the light actually used in projecting the image by means of a diaphragm in the projecting lens, and (2) using a collimating lens to collect the "parallel" rays from the model, the aperture of the projecting lens diaphragm being placed at the principal focus of this collimating lens. A.

535.551 : 548.0 : 539.319 *see Abstr.* 2214

535.642.1 : 612.843.32 *see Abstr.* 2279

535.65 : 628.9 2099

The illuminant in textile color matching. NICKERSON, D. *Illum. Engng, N.Y.*, **43**, 416–67 (*April*, 1948). See also abbrev. rep. in *J. Opt. Soc. Amer.*, **38**, 458–66 (*May*, 1948).—[Abstr. 2074 B (1948)].

535.66 : 535.312 2100

The color of unstained wood. MOON, P., AND SPENCER, D. E. *J. Opt. Soc. Amer.*, **38**, 405–8 (*April*, 1948).—Reflectances and colours are given for various natural woods. The results are summarized in a table, which gives the coefficients for empirical equations that fit all the spectral reflectance curves, and a second table which gives integrated values obtained by the analytic method. Clear varnish is found to reduce reflectance to approximately 85% of that for the unvarnished wood. A.

535.767 : 535.8 *see Abstr.* 2101

535.8 : 531.258 : 535.55 *see Abstr.* 2098

535.8 : 535.767 2101

A simple stereoscope for viewing double-lens camera stereographs without transposition. SCHOOLEY, A. H. *Science*, **107**, 281 (*March* 12, 1948).

535.822 2102

Phase microscopy with vertical illumination. JUPNIK, H., OSTERBERG, H., AND PRIDE, G. E. *J. Opt. Soc. Amer.*, **38**, 338–42 (*April*, 1948).—Phase microscopy has been adapted for observing specularly reflecting specimens with the vertical illuminator. The specimen is illuminated by light, preferably monochromatic, issuing from an annular opening in a diaphragm placed at the entrance pupil of an optical system consisting of the field lens, the microscope objective, and the reflecting surface of the specimen. The diaphragm is imaged on a diffraction plate placed at the exit pupil of this system. Stray light and illumination losses are minimized by locating the exit pupil between the beam splitter and the eyepiece. The method can be used advantageously to examine those surface irregularities which give rise to small differences in optical path or in phase between the reflected-ray bundles. Both bright and dark contrast with excellent definition may be obtained by the use of suitable diffraction plates. The advantage of this method disappears when the specimen diffuses the incident light. A.

535.822 : 535.313 : 539.17 *see Abstr.* 2195

535.822.9 : 535.417 : 535.321 2103

An interference microscope for the study of inhomogeneous media. AMBROSE, E. J. *J. Sci. Instrum. Phys. Ind.*, **25**, 134–5 (*April*, 1948).—A modification of the Fabry–Perot interferometer is described which can be attached to a standard microscope and used to measure small localized changes of refractive index within a specimen. The specimen can be, for example, a gel formed by diffusion of a liquid into a transparent solid or a section of chemical or biological interest; a thickness of up to 5 mm can be studied. A

HEAT 536

536.2 : 621.778.6 = 3 2104

Temperature distribution in wires during wire-drawing. KORST, H. *Öst. Ingen.-Arch.*, **2** (*No.* 2) 132–7 (1948) *In German.*—[Abstr. 2066 B (1948)].

536.2.083 : 621.315.3 : 621.317.39 = 3 2105

Thermal conductivity measurements on wire insulating coverings. MOELLER, F., AND MÖLLER, H. D. *Arch. tech. Messen., Issue No.* 152 (*Ref. V*9213-4) *T*28 (*Oct.*, 1947) *In German.*—[Abstr. 1937 B (1948)].

536.22 : 532.13 : 532.7 *see Abstr.* 2033

536.24 = 4 2106

Thermo-mechanical inertia. VERNOTTE, P. *C.R. Acad. Sci., Paris*, **225**, 1289–90 (*Dec.* 22, 1947) *In French.*—Attention is called to the work of the author and E. Blouin [*Publications scientifiques et techniques du Ministère de l'Air, Paris, No.* 36, *p.* 47 (1933)] in which the concept of thermo-mechanical inertia was introduced, analogous to the electrical case, in order to explain the deviation from the classical law of the experimental relationship obtained for the reheating of a mass of air by the walls of the container. The analogy fails when applied to large masses of air. [See Abstr. 2861 (1946) and 1974 (1935)]. S. W.

536.33 2107

Some notes on heat transfer by radiation. JENSEN, H. H. *K. Danske Vidensk. Selsk. Mat.-fys. Medd.*, **24** (*No.* 8) 26 *pp.* (1948).—The heat transfer by radiation between two bodies at different temperatures, one body entirely surrounding the other, is investigated theoretically, with special reference to the dependence on the form and mutual position of the bodies. Integral equations giving the net loss of energy H are derived for both "grey" surfaces and the general case. An approximate solution of the equations and a formula for H are obtained for "grey" surfaces and applied to two spheres, a plane disc inside a sphere, and two infinite circular cylinders. The effects on H of the non-validity of Stefan-Boltzmann's law and of the cosine law for reflection both at the inner and outer surfaces, and the variation over the surface of the temperature and emissivity of the outer body, giving the resultant radiation field within a closed cavity, are considered. The equations determining the apparent emissivity of a cavity are obtained and solved for a cavity shaped as a spherical cap. S. W.

536.37 2108

Mass emissivity of powder gases in solid fuel rockets. PENNER, S. S. *J. Appl. Phys.*, **19**, 278–85 (*March*, 1948).—An analysis was carried out to determine an upper limit for the effective mass emissivity of the radiating gases in a solid fuel rocket motor. The calculations depend upon a comparison between experimental performance data relating to a rocket motor and theoretical results based on a theory for the effect of radiation on the performance. A simplified treatment is developed for correlating the rate of burning of the powder with the temperature rise of a powder grain caused by the absorption of radiant energy. A.

536.421.1 : 531.44 *see Abstr.* 2019

536.423.15 = 3 2109

Determination of vapour pressure of glycol–water mixtures at temperatures up to 150°C. HELLWIG, W. *Z. angew. Phys.*, **1**, 9–11 (*Jan.*, 1948) *In German.*

536.423.15 : 532.6 2110

Relationships of vapour pressure, capillarity and temperature in clays. VASSILION, B., AND WHITE, J. *Nature, Lond.*, **161**, 487–8 (*March* 27, 1948).

536.423.4 : 551.578.1 = 4 *see Abstr.* 2274

536.46 : 535.338.1 *see Abstr.* 2070

536.46 : 535.343.4 : 535.338.1 *see Abstr.* 2069

536.462 2

A Bunsen flame as a column of luminous gas. LE A. S., AND DAVID, W. T. *Nature, Lond.*, **161**, (*April* 3, 1948).—By surrounding a Bunsen flame wit tube of appropriate diameter (or a series of tubes increasing diameter) the cooling of the gases by turbul mixing with cold air is prevented, and a luminous colu of height approaching 3 ft can be obtained. The col changes in the column are described.

536.48 : 531.19 = 3 *see Abstr.* 2018

536.48 : 532.7 2

Liquid helium II. GREEN, H. S. *Nature, Lond.*, 1 391 (*March* 13, 1948).—The quantized kinetic theory liquids [Abstr. 2051, 3435 (1947)] has been fou capable, without further assumption, of explaining the properties of liquid He II. The important factor the distinction between "thermodynamic" and "kinet properties, particularly pressure, at temps. below λ-point. The theory is equally applicable to sup conductivity.

536.63 : 548.7 *see Abstr.* 2252

536.632 21

Specific heats of volatile liquids. WILLIAMS, G. *Industr. Engng Chem.*, **40**, 340–1 (*Feb.*, 1948).— modification of the standard electrical heating meth is described. The specific heat is determined from t relation: time rate of heat input = (thermal capac of liquid + container) $[(dT/d\theta) - (dT_0/d\theta)]$, where dT and $dT_0/d\theta$ are the temp./time rates of the liquid, duri the period of heating, and during the periods prior to a subsequent to the heat addition, respectively. Resu of a test on a benzene-methanol mixture are given. S.

536.652 = 4 21

The ratio between the molecular heat of fusion and t absolute temperature of fusion for monoatomic metals a of chemical compounds. PROCOPIU, S. *Bull. Éco Polyt. Jassy*, **2**, 125–40 (*Jan.–June*, 1947) *In French.* From a consideration of existing data for monoaton metals, di- and tetra-atomic elements, and inorgar and organic compounds, it is concluded that the abo ratio is a constant for groups of analogous substanc although it varies from group to group. The value of t constant is determined by the energies of translatio rotation, ionization, and polymerization associated wi each atom of the chemical compound. H. H. H

536.658 : 532.516 : 541.183 *see Abstr.* 2232

THERMODYNAMICS 536.7

536.71 = 4 21

Contribution to the research on the equation of state fluids. MILOSAVLIEVITCH, D. *C.R. Acad. Sci., Paris*, 22 1288 (*Dec.* 22, 1947) *In French.*—An expression for t function $\phi(T)$ in a previously proposed equation for t saturation curve [Abstr. 611 (1948)] is given. It contai the critical and triple point temperatures as parameter The equations are now found to be valid for all real gas at pressures below the critical value. This has be verified in the case of C_6H_{12}, CO_2, and water. [No da given]. The Boyle temperature of N as calculated fro the equations is 76°C, whereas those of Van der Waa and Clausius give 152°C and 38°C respectively. Chappi has found the value to lie between 50°C and 70°C. F. E. F

536.75 : 531.19 : 530.145.6 = 3 *see Abstr.* 2017

ELECTRICITY 537

.123 : 537.363 = 4 *see Abstr.* 2125

.133 : 539.163.2 *see Abstr.* 2184

.226.08 : 548.0 2116

he dielectric constant measurement of powdered regular talline solids. VAN VESSEM, J. C., AND BIJVOET, J. M. *Trav. Chim. Pays-Bas*, **67**, 191–6 (*March*, 1948).—grain-size effect must be taken into account. For $_2$ ratios up to 3 special precautions are not necessary; ratios up to 6 the effect may be eliminated by using a ge capacitor (500 cm³) and a powder of fine grain-size 02 mm). Former measurements of several authors not be relied upon. Measurements of NaCl and KCl vder at different filling-fractions under ideal conditions powder-sizes, and of NH_4Cl and KCl floating in $_4$–C_6H_6 prove that the Böttcher and Wiener–ggeman powder-formulae give good results. A.

'.226.2 2117

The dielectric properties of solid and liquid *cis*- and *ns*-decahydronaphthalene. SEYER, W. F. AND BARW, G. M. *J. Amer. Chem. Soc.*, **70**, 802–5 (*Feb.*, 48).—The permittivities at 3·5 Mc/s and 20°C are 219 ± 0·003 and 2·184 ± 0·003 respectively. Neither ows anomalous behaviour between −40° and 100°C d the temp. coefficient of each between the f.p. and 0°C is 0·0010/deg. Measurements of the permittivities the f.p. and in the solid phase reveal marked differences tween the two isomers. Molar polarizations have been culated at different temps. and, since that of the *ns*- isomer is slightly > the *cis*, it is considered that the mer has a less compact structure than the latter.

W. R. A.

ELECTRIC CURRENTS 537.3

7.311.1 : 669.231 : 621.316.84 = 4 2118

Electric conduction of very thin coatings of platinum at w temperatures. VODAR, B., AND MOSTOVETCH, N. *R. Acad. Sci., Paris*, **226**, 167–8 (*Jan.* 12, 1948) *In ench.*—[Abstr. 1704 B (1948)].

7.311.62 : 537.312.62.029.6 *see Abstr.* 2123

7.311.62 : 621.396.611.4 2119

Surface resistance of metal films at a frequency of 4 000 Mc/s. SPEIRS, L. *Nature, Lond.*, **161**, 601 (*April* 17, 1948).—Measurements were made of the sonance conditions for a H_{01} cylindrical cavity loaded ith a film (5–300 Å) of metal (Cr, Au, Al, Ag, Cu, Ni) arried on a low-loss plunger. The theoretical [Abstr. 606 (1948)] value of surface resistance deduced from ese measurements was compared with the d.c. value easured directly; the quantitative agreement was good, he ratio of the two values generally lying between 1 nd 2. This indicates that there is no dispersion in the etal at this frequency.

37.312.5 : 535.37 *see Abstr.* 2085

37.312.5 : 549.211 2120

Directional variations of photoconductivity in diamond. CHYUTHAN, K. *Proc. Indian Acad. Sci. A*, **27**, 171–5 (*Feb.*, 1948).—The photoconducting behaviour of five cleavage plates of diamond of different thicknesses varies with direction, being greatest in the direction of some laminae which are shown up through producing streaks in the birefringence pattern photographs. Conductivity is increased wherever birefringence is weak. A tentative explanation is advanced. W. R. A.

537.312.6 : 621.317.794 2121

The d.c. thermal characteristics of microwave bolometers. PESKIN, E., AND WEBER, E. *Rev. Sci. Instrum.*, **19**, 188–95 (*March*, 1948).—[Abstr. 1744 B (1948)].

537.312.62 2122

Incipient superconductivity in titanium. WEBBER, R. T., AND REYNOLDS, J. M. *Phys. Rev.*, **73**, 640 (*March* 15, 1948).—The resistance of a pure Ti specimen was observed to fall between 3 and 1·1°K; it is suggested that this is due to a trace of superconducting impurity and that Ti itself may become superconducting only at lower temperatures. [See Abstr. 521 (1940)]. D. S.

537.312.62.029.6 : 537.311.62 2123

Theory of the anomalous skin effect in metals. REUTER, G. E. H., AND SONDHEIMER, E. H. *Nature, Lond.*, **161**, 394–5 (*March* 13, 1948).—Pippard's [Abstr. 3541–3 (1947)] equations have been reformulated on a more rigorous basis, and explicit solutions have been obtained.

537.312.9 : 539.4.016.2 *see Abstr.* 2220

537.323.091 : 539.37 = 4 2124

Effect of deformation on the thermo-electric power of metals. CRUSSARD, C., AND AUBERTIN, F. *C.R. Acad. Sci., Paris*, **226**, 75–6 (*Jan.* 5, 1948) *In French.*—Measurements were made for Cu, Al, Fe and Ni for elastic and plastic deformations. The results show that the effect is much greater for the ferromagnetic metals than for Cu and Al. A. E. DE B.

537.363 : 537.123 = 4 2125

Apparent electrophotophoretic charges smaller than the electron. TAUZIN, P. *C.R. Acad. Sci., Paris*, **225**, 995–7 (*Nov.* 24, 1947) *In French.*—Evidence for the existence of electrophotophoretic charges, carrying a charge of $\sim \frac{1}{4}$ that on the electron, has been adduced from experiments conducted with Cu vapour and with vaseline.

W. R. A.

537.363 : 541.182.63 = 4 2126

Origin of the charge on suspensions of laminar [phyllitеux] minerals and its relation to the reticular surface structure of these minerals. KIEFER, C. *C.R. Acad. Sci., Paris*, **225**, 1071–3 (*Dec.* 1, 1947) *In French.*—Two distinct phenomena which give rise to micellar charge (dissociation and adsorption of ions) are discussed. The variation of electrophoretic velocity with concentration enables approximate evaluation of the contribution of each factor in different types of minerals. W. R. A.

537.364 : 539.211 2127

Electrokinetic potential and surface structure of barium sulphate. BUCHANAN, A. S., AND HEYMANN, E. *Nature, Lond.*, **161**, 649 (*April* 24); Reprinted *Id.*, 691 (*May* 1, 1948).—The ζ-potential of recrystallized Ba sulphate against its solid solution was found to be much higher than that of natural barite. This is probably due to the relatively irregular faces of the crystals of the former.

ELECTRIC DISCHARGES AND RADIATIONS 537.5

537.521 : 551.594.221 = 82 *see Abstr.* 2276

537.521.7 2128

Statistical factors in spark discharge mechanisms. LOEB, L. B. *Rev. Mod. Phys.*, **20**, 151–60 (*Jan.*, 1948).—The historical development of the streamer theory is briefly discussed. The well-known Townsend sparking condition $\gamma e^{\alpha\delta} = 1$ is critically and closely examined, and is shown to lead to a definition of "sparking threshold." The streamer mechanism is then developed to give another sparking threshold criterion $efe^{\alpha x} = 1$ (f is a numerical factor and e is the chance that one or more photons ionize sufficiently, in a certain high field volume element round the streamer tip, to allow propagation to take place). J. D. C.

537.523 2129

Transition from glow to arc discharge. BRUCE, C. E. R.

Nature, Lond., **161**, 521–2 (*April* 3, 1948).—Stroboscopic photographs are shown of two stages of an a.c. discharge in H_2 at 1 atmos. between water-cooled Cu electrodes. The change from glow to arc is observed to start near the anode and spread towards the cathode, which remains covered with the glow characteristic of the glow discharge throughout. Thus the transition is independent of cathode conditions, and occurs in the column itself. The suggestion is advanced that the surface of the solar photosphere is located where the pressure is just too low (1/100 atmos.) for the glow/arc transition to take place.

537.523.3 2130

The threshold for the positive pre-onset burst pulse corona and the production of ionizing photons in air at atmospheric pressure. LOEB, L. B. *Phys. Rev.*, **73**, 798–800 (*April* 1, 1948).—Describes briefly the various forms of corona discharge and their connection with Geiger counter discharges. The burst pulse onset voltage in a particular experiment was consistent with a photon absorption coefficient lying, reasonably, between 10 and 100 cm^{-1}. J. D. C.

537.525.5 = 3 2131

The effect on the positive column of a transverse magnetic field. WASSERRAB, T. *Z. Naturforsch.*, **2a**, 575–82 (*Oct.*, 1947) *In German.*—The effect of a transverse magnetic field on the radial structure of a low pressure arc discharge is derived theoretically, in satisfactory agreement with measurements made (by a photoelectric method) at vapour press. of 10^{-3}–10^{-2} mm Hg in a Hg discharge. At higher vapour press. and with strong fields, disturbing effects, such as "layer formation," were observed. J. D. C.

537.525.5 : 537.534 2132

Experiments with an arc ion source for the cyclotron. ATTERLING, H. *Ark. Mat. Astr. Fys.*, **35 A** (*Paper* 32) 16 *pp.* (1948).—An arc ion source used in 32-in cyclotron in Stockholm is described in detail. The effects of different filaments, gas flows and arc currents were investigated and the relation of ion output to electron emission and dee voltage found. Deuteron currents to an internal target of 100–200 μA were obtained using a hooded arc. An indirectly heated W point within the filament spiral appeared to give a very concentrated beam of electrons. J. H. F.

537.531 : 535.34 : 545.824 *see Abstr.* 2240

537.531 : 535.43] + 548.736.442 *see Abstr.* 2262

537.531 : 539.25 : 539.215.4 = 4 *see Abstr.* 2212

537.531 : 621.386.832 : 535.371.07 *see Abstr.* 2087

537.533.7 : 621.385 2133

Possible fluctuations in electron streams due to ions. PIERCE, J. R. *J. Appl. Phys.*, **19**, 231–6 (*March*, 1948).—The equations for low amplitude space-charge waves in an electron stream containing heavy positive ions are considered. At frequencies a little below the ion plasma frequency there should be a wave which increases in amplitude as it travels (negative attenuation). Ion motion tends to limit the rate of increase. In a beam filling a conducting cylinder and confined by a uniform magnetic field there should be an increasing wave at frequencies near the ion cyclotron frequency. Such waves might explain observed fluctuations in long electron beams. A.

537.533.7 : 778.34 2134

Electron tracks in photographic emulsions. BERRIMAN, R. W. *Nature, Lond.*, **161**, 432 (*March* 20, 1948).—A new emulsion, when exposed to γ-rays, was found, on microscopical examination under high magnification after development, to contain short, highly curved chains of developed grains, which are believed to be electron tracks.

537.533.72 21

A beta-ray spectrometer design of quadratic resolution-solid angle relationship. FRANKEL, S. *Phys. Rev.*, 7 804 (*April* 1, 1948).—Attention is drawn to the improvement in the momentum resolution which is attainab without decrease of solid angle in the solenoid spectrometer by placing baffles inside and outside the "ri focus." The best resolution is obtained by placing the baffles so that their defining edges lie on a cone wi vertex at the source and axis parallel to the magnet field. Momentum resolution/solid angle curves for point source show this ring-focus-baffled soleno spectrometer to be superior to other types in this respec Consideration is given to the use of an extended source R. W.

537.533.9 21

On the investigation of specimen contamination in th electron microscope. HILLIER, J. *J. Appl. Phys.*, 1 226–30 (*March*, 1948).—Experiments directed on th nature and cause of deposits which occur on electro microscope specimens under electron bombardment a described. It is concluded that the material is a resu of chemical reaction, occurring at any surface simu taneously bombarded by electrons and organic molecule The organic vapours are shown to arise in two way (1) by diffusion out of the metal walls, gaskets, an greases exposed to the vacuum, (2) by the outgassing o metal parts of the instrument exposed to electron bom bardment. To eliminate the effect both sources mus be removed.

537.534 : 537.525.5 *see Abstr.* 2132

537.534.72 213

A special case of velocity focusing in a magnetic fiel KOCH, J. *K. Danske Vidensk Selsk. Mat.-fys. Medd* **24** (*No.* 7) 22 *pp.* (1948) *In English.*—The effect of sma fluctuations of accelerating voltage in a mass spectromete using a wedge-shaped magnetic field may be compensate by applying a transverse deflecting electric field, betwee the ion source and the magnet, proportional to the fluctua tions. Graphical methods for determining the constan of proportionality are given, together with a geometrica optical construction for the ion paths in the spectrometer T. G. P.

537.534.74 : 539.152.1 = 3 *see Abstr.* 2172

537.534.74 : 539.185 *see Abstr.* 2208

537.534.74 : 539.185 : 530.145 *see Abstr.* 2013

537.54 : 621.327.3/.4 = 82 213

Physics of new light sources. FABRIKANT, V. A *Elektrichestvo* (*No.* 10) 12–18 (1947) *In Russian.*—Fluorescent and high-pressure gas discharge lamps ar considered in detail. The radiation consists mainly o the Hg lines: 1 849·57 and 2 536·52 Å, the energy distribution in fluorescent lamps being 30% and 60% resp A theory of the generation of the line 2 536·62 Å i proposed, based on the coexistence of two gases of very different temperatures: a rare gas at $< 1\,000$°K and a electron gas of temperatures up to $> 10\,000$°K heated by the electric field of the discharge. The various gases are shown to possess different metastable energy levels the case of Hg being particularly important. The discharge is considered as a spatial radiator, and a new experimental technique using luminescent probes excited by the discharge is described. High-pressure discharge lamps are discussed; their electron and vapour temperatures are of the same order owing to the small mean

path of the electrons. The purely thermal theory of Hg vapour discharge due to Elenbaas is criticized. erimental methods are described for overcoming the itational forces responsible for convection currents.
A. L.

542 : 539.164.08 = 3 2139

new counter tube discharge process, obtained with ngly ionizing particles. HUBER, P., HUNZINGER, W., BALDINGER, E. *Helv. Phys. Acta*, **20** (*No.* 6) 525–7 7) *In German.*—Experiments with a Po α-ray source, ed about in a special double Geiger counter, indicate α-particles travelling radially give rise to abnormally e pulses. The phenomenon is considered to be sed by the heavy primary (α particle) ionization which is to give space charge neutralization, in contrast with normal Geiger discharge. J. D. C.

542 : 545.828 *see Abstr.* 2242

COSMIC RAYS 537.591

591 2140

Cosmic rays at 30 000 feet. ADAMS, R. V., ANDERSON, D., LLOYD, P. E., RAU, R. R., AND SAXENA, R. C. *Mod. Phys.*, **20**, 334–49 (*Jan.*, 1948).—Data are en of the operation of a 17-cm cloud chamber in a d of 7 500 gauss at altitudes up to > 30 000 ft. The urrence in photographs of groups of shower particles compared with the occurrence of single particles at), 14 000 and 30 000 ft. There is less change between 00 and 30 000 ft than between 800 and 14 000 ft, ile the altitude variation is in general agreement with results obtained by other methods. A momentum ctrum at 30 000 ft, based on 246 measured tracks of rticles occurring singly, shows a large positive excess, ich includes a strong peak at $H\rho \sim 2 \times 10^6$ gauss cm ich is due to protons. There is no indication of a responding peak which might be due to negative otons. J. G. W.

7.591 2141

Cosmic-ray effects from solar flares and magnetic storms. HER, H. V., AND ROESCH, W. C. *Rev. Mod. Phys.*, , 350–2 (*Jan.*, 1948).—Ionization chamber data on smic ray intensity variations during the magnetic storm July 25, 1946, agree with observations reported elsewhere. During the later stages of the disturbance (cosmic y intensity < normal) a balloon flight showed a reduction of the maximum threefold coincidence rate of ~ 18% a time when the comparable sea-level reduction was 6%. J. G. W.

7.591 : 523.31 2142

Cosmic rays and the magnetic field of the moon. ALLARTA, M. S. *Nature, Lond.*, **161**, 646–7 (*April* 24, 48).—A magnetic field as low as predicted by Chapman bstr. 3408 (1947)] on Blackett's theory could only fect very slow cosmic ray particles, which are able to ach the earth only very near the geomagnetic poles.

7.591 : 550.42 : 539.172 *see Abstr.* 2199

7.591.08 2143

A new cosmic-ray telescope for high altitudes. BIEHL, T., MONTGOMERY, R. A., NEHER, H. V., PICKERING, H., AND ROESCH, W. C. *Rev. Mod. Phys.*, **20**, 353–9 an., 1948).—A threefold coincidence telescope, 1 m ng, 600 cm² collecting area, 15° square angle of collection, suitable for operation with balloons up to ~0·6 m ater equivalent, is described, in which the all-up weights the counter arrays are kept to a minimum. The performance of such a counter system at high counting rates, nd the calibration of a set of units, is described. J. G. W.

537.591.1 2144

On the positive excess of the penetrating component at 17 000 feet. QUERCIA, I. F., RISPOLI, B., AND SCIUTI, S. *Phys. Rev.*, **73**, 516 (*March* 1, 1948). [See also *Nuovo Cim.*, **4**, 283–5 (*Oct.*, 1947) *In Italian*].—Partial separation of the positive and negative components of cosmic rays at 17 000 ft was achieved in a magnetic lens (particles passing through magnetized Fe) [Abstr. 518 (1946)], and the positive excess was estimated for approximate energy ranges $\geqslant 2{\cdot}3 \times 10^8$ eV, and $\geqslant 4{\cdot}6 \times 10^8$ eV. It is concluded that the positive excess increases from ~ 14% near sea level to ~ 35% at 17 000 ft. J. G. W.

537.591.1 = 4 2145

On the mass of particles in the penetrating component of cosmic rays. LHÉRITIER, M., PEYROU, C., AND LAGARRIGUE, A. *C.R. Acad. Sci., Paris*, **225**, 1304–6 (*Dec.* 22, 1947) *In French.*—At altitude 1 000 m, the momentum of cosmic ray particles, previously filtered in 72 cm Pb, which then stop in a further thickness of Pb between 4 and 8 cm, was measured. While the results (33 events) can be explained in terms of a unique meson mass of about 250 m_0, they are better interpreted in terms of two particles, masses about 200 m_0 and 300 m_0. This conclusion is not in contradiction with measurements by Fretter [Abstr. 902 (1947)] since the work refers to heavily filtered cosmic rays which should be rich in a more unstable component. J. G. W.

537.591.15 2146

On neutral mesons in cosmic rays. GREISEN, K. I. *Phys. Rev.*, **73**, 521–2 (*March* 1, 1948).—The increase in the rate of large cosmic ray bursts with altitude is explained in terms of the formation of neutral mesons among other particles in nuclear collisions, by nucleons or heavy mesons, and the decay with very short lifetime of each neutral meson into two photons. It is suggested that this mechanism also explains the presence of both electrons and penetrating particles in complex showers, and the relation between extensive air cascades and the associated penetrating particles. J. G. W.

537.591.15 = 4 2147

Treatment of observations on extensive showers. DAUDIN, J. *J. Phys. Radium* (*Sér.* 8) **8**, 301–5 (*Oct.*, 1947) *In French.*—The probability of operation of counter arrays, and the probable number of particles traversing a given area (e.g. the collecting area of a cloud chamber) when showers are assumed to consist of particles occurring at random, and with a small space rate of change of mean particle density, is examined in terms of the density spectrum of the showers. J. G. W.

537.591.15 = 4 2148

On a new type of penetrating particle in extensive cosmic ray showers. AUGER, P., DAUDIN, J., FRÉON, A., AND MAZE, R. *C.R. Acad. Sci., Paris*, **226**, 169–70 (*Jan.* 12, 1948) *In French.*—The absorption in Pb of extensive air showers, the Rossi curve for the particles in these showers and the degree of multiplication of the shower particles in Pb, are interpreted in terms of new particles, of a few times the electron mass, which comprise about ¼ of all ionizing particles in the extensive showers. J. G. W.

537.591.15 = 5 2149

On the penetrating component in extensive air showers. SALVINI, G., AND TAGLIAFERRI, G. *Nuovo Cim.*, 4, 279–82 (*Oct.*, 1947) *In Italian.*—Using two sets of three counters each, the first screened by 30 cm of Pb, the second by 10 cm of Pb and 30 cm of Fe, situated among many other counters covering a triangular area of side ~ 9 m, the authors investigated the penetrating component of the extensive air showers. They found that

the ratio of the frequency of soft to hard particles in large showers is independent of the density of the showers and that the penetrating particles are formed in the neighbourhood of the counters. The ratio of the number of particles under Pb to that under Fe was in agreement with previous experiments. G. P. S. O.

537.591.3 2150

On heavy mesons and the cosmic rays far underground. GREISEN, K. I. *Phys. Rev.*, **73**, 521 (*March* 1, 1948).—The change of slope of the absorption curve of cosmic rays at about 300 m water-equivalent is consistent with the formation of normal mesons as the product of the decay of a meson of mass $330\,m_0$ and proper lifetime $\sim 6\times10^{-8}$ sec. This mechanism would also lead to a positive temperature coefficient at great depths. J. G. W.

537.591.5 2151

Recent studies of the cosmic-ray latitude effect at high altitudes. BIEHL, A. T., MONTGOMERY, R. A., NEHER, H. V., PICKERING, W. H., AND ROESCH, W. C. *Rev. Mod. Phys.*, **20**, 360–6 (*Jan.*, 1948).—Threefold coincidence units [Abstr. 2143 (1948)] were flown from stations between 38° N and 60° N magnetic latitude after calibration against a standard unit to 1%. The transmitted barometer readings are the major source of uncertainty. The result that the maximum of cosmic ray intensity does not increase for all increases of magnetic latitude is taken to indicate that the latitude variation may be masked by variations in time. J. G. W.

537.591.5 2152

Altitude dependence of high energy atmospheric showers. KRAYBILL, H. L. *Phys. Rev.*, **73**, 632 (*March* 15, 1948).—The variation with altitude of extensive cosmic ray showers selected by counter arrays of maximum separations from 9 to 42 ft was measured to an altitude of 40 000 ft. The counting rate at 37 000 ft $\simeq 0{\cdot}70\times$ that at 31 000 ft, while the ratio of coincidences between counters separated by a large distance to those between near counters increases between 31 000 and 37 000 ft. The maximum count for the particular counter geometry used was reached at $\sim$ 27 000 ft. J. G. W.

537.591.5 2153

The hard component of cosmic radiation as affected by the variation in air mass distribution with latitude. KUPFERBERG, K. M. *Phys. Rev.*, **73**, 804–5 (*April* 1, 1948).—Measurements of the geomagnetic latitude effect of the hard component of cosmic rays must take account of the variation with latitude of the 100-mb layer of the atmosphere at which meson formation is considered to take place. Averaged over the year, the variations of meson intensity at sea level with latitude which would be expected to arise from the difference of mean height of the 100-mb layer and the consequent differences of decay probability are shown, assuming a p^{-3} meson spectrum at formation, to be comparable in magnitude and similar in type to those actually observed and normally attributed wholly to a geomagnetic effect. J. G. W.

537.591.5 : 539.18 2154

Height of meson formation. DUPERIER, A. *Nature, Lond.*, **161**, 645 (*April* 24, 1948).—Further evidence is presented supporting the view that the 7·5-cm pressure level is the average height of formation of mesons [see Abstr. 1095 (1946)].

537.591.8 2155

Secondary electrons produced by mesons. WILSON, J. G. *Phys. Rev.*, **73**, 525 (*March* 1, 1948).—The probable number of electrons ($p > 10^7$ eV/c) accompanying the normal meson beam emerging from a Pb absorber at sea level as given by Nassar and Hazen [Abstr. 1908 (1946)] is shown to be in agreement with a value given Wilson [*Nature*, **142**, 73 (1938)] and to be $\sim 2{\cdot}2\%$. J. G.

537.591.8 : 539.17 2

The production of nuclear disruptions by the cos radiation. KORFF, S. A. *Rev. Mod. Phys.*, **20**, 327 (*Jan.*, 1948).—A general discussion of the characteris of the agencies initiating nuclear disruption and of distribution of particles generated in these events. J. G.

537.591.8 : 539.172 *see Abstr.* 2200

MAGNETISM 538

538 : 530.1 = 4 *see Abstr.* 2004

538 : 531.15 : 530.1 *see Abstr.* 2003

538.1 = 4 2

The movement of particles in uniform and non-unifo magnetic fields. EHRENHAFT, F. *C.R. Acad. Sci., Pa.* **225**, 926–8 (*Nov.* 17, 1947) *In French.*—From a study the movement of particles in uniform and non-unifo magnetic fields it is considered necessary to introduce principle of isolated, unipolar, magnetic charges. W. R.

538.113 2

Note on diamagnetism: clarification of relati between fundamental molecular theories. BARNETT, S. *Rev. Mod. Phys.*, **20**, 78–81 (*Jan.*, 1948).—Weber's the of diamagnetism, its relations to Langevin's theory, a a composite theory containing ideas of both the oth are discussed. W. R.

538.22 : 549.623.5 2

Magnetic susceptibility of mica. KENDALL, J. T., A YEO, D. *Nature, Lond.*, **161**, 476–7 (*March* 27, 1948). The surprising paramagnetic susceptibility of synthe mica is shown to be due to magnetite inclusions.

538.221 2

Ferromagnetic structure of cold-worked austeni stainless steels. HOBSON, P. T., AND OSMOND, W. *Nature, Lond.*, **161**, 562–3 (*April* 10, 1948).—Conside tion of audio-frequency magnetic recording chara teristics of steel wire is used to show that the wire (whi can have a coercivity as high as 500 oersteds) probab contains a dispersion of ferrite particles, long in relati to cross-section, of individual volume $\sim$ a single doma in a non-magnetic matrix of austenite [see Abstr. 3259 (1947); 681 (1948)].

538.222 2

Paramagnetic resonance at low temperatures in chron alum. BLEANEY, B., AND PENROSE, R. P. *Proc. Phy Soc., Lond.*, **60**, 395–6 (*April*, 1948).—The Stark splittir due to the crystalline electric field, of the basic sp quadruplet of Cr^{+++} ion in the K and NH_4 chror alum was examined at low temperatures because of t differences obtained for these respective splittings room and low temperatures. The results for the NI compound show a linear decrease from $0{\cdot}13\ cm^{-1}$ room temp. down to 80°K, where a transition sets which takes several minutes to complete, finally reachi a value of $0{\cdot}317\ cm^{-1}$ at 20°K. This transition shows hysteresis, the discontinuity not setting in till a temp. 100°K is reached on heating the crystal. A simil hysteresis in the dielectric permittivity is noted [*C. Acad. Sci., Paris*, **209**, 21 (1939)]. No such discontinui or hysteresis is found for the K chrome alum. W. E.

538.23 : 621.3.013 = 82 2

Calculation of electric circuits, allowing for hysteres loss. BESSONOV, L. A. *Elektrichestvo* (*No.* 1) 45– (1948) *In Russian.*—[Abstr. 1800 B (1948)].

27 : 539.4.016.2 2163

train sensitivity of magnetic susceptibility. HUTCHI-, T. S., AND REEKIE, J. *Phys. Rev.*, **73**, 517–18 *rch* 1, 1948).—Curves are given of the variation of eptibility of pure Cu and Al rods with the degree of l working, and the changes are ascribed to the com-ed effects of lattice distortion and fragmentation. magnetic self-recovery in Cu [see Abstr. 2139 (1946)] ue to recovery from lattice distortion: no such effect urs in Al since it recovers from lattice distortion during l working. Confirmation that the stable change in eptibility is due to fragmentation is given by removing face layers (where fragmentation is most severe) by ning, when susceptibility reverts nearly to the annealed ue. C. E. W.

ECTROMAGNETISM . ELECTRODYNAMICS 538.3/.5

.3 : 530.14 *see Abstr.* 2010–11

3.566.3 : 551.510.535 *see Abstr.* 2268

MAGNETIC EFFECTS 538.6

3.61 : 539.13 = 4 2164

Magneto-optical determination of the structure of the ocyanate ion. VOIGT, D. *C.R. Acad. Sci., Paris*, **225**, 51–2 (*Dec.* 10, 1947) *In French.*—The magneto-optical wer of the $(SCN)'$ ion has been deduced from measure-nts on solutions of NaSCN, KSCN, NH_4SCN, and $(SCN)_2$ and is practically identical with the value for first member of the mustard oil series. Whilst it is ssible that the ion possesses different forms in resonance, is considered that the (SCN) form predominates cause of the stability and symmetry of this structure. W. R. A.

8.65 : 539.32.098 2165

The variation with magnetization of Young's modulus r cobalt. STREET, R. *Proc. Phys. Soc., Lond.*, **60**, 6–43 (*March*, 1948).—The variation with magnetization Young's modulus (ΔE-effect) was investigated for ecimens of annealed and unannealed Co for field tensities up to ~ 700 oersteds. The specimens, in the rm of bars, were excited with resonant longitudinal brations by magnetostrictive oscillation and the riation of E measured as a change of resonant fre-uency. The decrement of longitudinal oscillation was lso measured. A. E. DE B.

TOMIC AND MOLECULAR STRUCTURE 539

39.11 : 548.7 = 3 *see Abstr.* 2253–4

39.13 = 4 2166

Method of calculating the electron distribution of the yridine nucleus and the dipole moment. PLOQUIN, J. *.R. Acad. Sci., Paris*, **226**, 245–7 (*Jan.* 19, 1948) *In rench.*—The present author has reversed the procedure dopted by Wheland and Pauling [Abstr. 21 (1936)], who treated the problem as a perturbation of the electron ffinity on the benzene nucleus and hence calculated the lipole moment. W. E. D.

39.13 : 535.343.4–14 *see Abstr.* 2077–79

39.13 : 538.61 *see Abstr.* 2164

39.132 2167

Molecular perturbations. VALATIN, J. G. *Hungar. Acta Phys.*, **1** (*No.* 1) 23–41 (1947).—The interaction between nuclear rotation and electronic motion in a diatomic molecule is investigated in a system of reference rotating with the nuclei. Observed perturbations are connected both with the rotational and the vibrational coupling. L. P.

539.132 = 3 2168

New quantum-mechanical treatment of CH_4 and NH_4^+. HARTMANN, H. *Z. Naturforsch.*, 2a, 489–92 (*Sept.*, 1947) *In German.*—These molecules have been treated quantum-mechanically as pseudo-Ne atoms by a method corresponding to Slater's method for atoms. The method yields values in good agreement with empirical data on atomic separations, susceptibility, and C–H binding moment. W. R. A.

539.132 = 3 2169

On the theory of the HCl molecule. HORVATH, J. I. *Experientia*, **4** (*No.* 4) 142–3 (1948) *In German.*—The binding energy of the HCl molecule has been recalculated on Gombás's and Neugebauer's statistical method, using Hartree's and Fock's eigenfunctions. A.

539.152.1 : 530.145 2170

The eigenfunctions for the ground state of the deuteron in a non-symmetrical theory. FRÖBERG, C. E. *Ark. Mat. Astr. Fys.*, **35 A** (*Paper* 17) 7 *pp.* (1948).—A mixture of neutral scalar and charged pseudoscalar mesons is used with the interaction constant and mass ($326\,m_e$) of the neutral mesons chosen to agree with p–p scattering data and an assumed mass (178) for the charged mesons. Using zero cut-off for the tensor forces inside the range of the neutral mesons the quadrupole moment and magnetic moment of the deuteron are obtained with a suitable choice of the remaining interaction constant. G. J. K.

539.152.1 : 535.338.4 2171

Spin of C^{14}. JENKINS, F. A. *Phys. Rev.*, **73**, 639 (*March* 15, 1948).—Observations of the band-spectrum of $C^{14}C^{14}$ show that the nuclear spin of C^{14} is zero and that it follows Bose–Einstein statistics. R. F. B.

539.152.1 : 537.534.74 = 3 2172

On the scattering of fast particles by a nucleus. SEXL, T. *Acta Phys. Austriaca*, **1** (*No.* 2) 178–87 (1947) *In German.*—A simple theory is used involving a limiting angular momentum $l_0\hbar$ associated with the velocity of the incident particle and the nuclear radius regarded as a distance of closest approach. Particles with $l < l_0$ are assumed to be totally absorbed, and those with $l > l_0$ to be unaffected if uncharged, or acted on by a Coulomb force only if charged. This assumption gives in general a $(1/\theta^3)$ law of small-angle scattering through an angle θ. A transition to the Rutherford scattering law $(1/\theta^4)$ is obtained as a limit at small velocities. G. J. K.

539.152.1 : 539.155.2 *see Abstr.* 2177

539.152.1 : 539.163.2 *see Abstr.* 2185

539.152.1 : 539.165.2 *see Abstr.* 2188

539.152.2 2173

The magnetic moments of Cu^{63} and Cu^{65}. POUND, R. V. *Phys. Rev.*, **73**, 523–4 (*March* 1, 1948).—Using a recording radiofrequency spectrometer the absorption frequencies of the Cu^{65} and Cu^{63} isotopes were measured and their ratio found to be $1{\cdot}0711 \pm 0{\cdot}0002$ while the corresponding ratio of the frequencies for Cu^{63} and Na^{23} was found to be $1{\cdot}0022 \pm 0{\cdot}0002$. Assuming the magnetic moment of Na^{23}, these results lead to the values $2{\cdot}2265 \pm 0{\cdot}0025$ and $2{\cdot}3847 \pm 0{\cdot}0030$ for the magnetic moments of Cu^{63} and Cu^{65} respectively. From observations on the line breadth in the case of $CuSO_4 . 5H_2O$, a lower limit for the spin-lattice relaxation time of about 10^{-4} sec is deduced. W. E. D.

539.152.2 2174

The hyperfine structure and nuclear moments of chlorine. DAVIS, L., JR., FELD, B. T., ZABEL, C. W., AND ZACHARIAS, J. R. *Phys. Rev.*, **73**, 525–6 (*March* 1, 1948).—Measurements were made on the hyperfine structure of the $^2P_{3/2}$ ground states of Cl^{35} and Cl^{37}, using an atomic beam magnetic resonance method. Assuming this structure to be given in terms of a magnetic dipole interaction constant a and an electron quadrupole interaction constant b the conclusions are drawn that (*a*) both isotopes have a nuclear spin of 3/2; (*b*) the value of $2a - b$ for Cl^{35} is $355{\cdot}231 \pm 0{\cdot}02$ and for Cl^{37} $298{\cdot}116 \pm 0{\cdot}02$ Mc/s; (*c*) $(b/a)^{35} = 0{\cdot}269 \pm 0{\cdot}006$; (*d*) the magnetic moment of Cl^{35} is positive. Assuming the value of g^{35}/g^{37}, values of a and b are deduced. Values of the nuclear quadrupole moment, Q, are deduced to a claimed accuracy of 0·25%. W. E. D.

539.153 2175

Energy of the ground-state of helium-like atoms. ERIKSSON, H. A. S. *Nature, Lond.*, **161**, 393–4 (*March* 13, 1948).—The discrepancy between measurements of the spectra of He-like atoms and theoretical calculations may be due to the same causes as were dealt with by Bethe [Abstr. 3608 (1947)].

539.153 : 535.338.332 *see Abstr.* 2072

539.153 : 548.736.34 *see Abstr.* 2260

539.155.2 2176

Mass-spectrographic separation of isotopes of gaseous elements. KOCH, J. *Nature, Lond.*, **161**, 566–7 (*April* 10, 1948).—Ne ions collected on Ag discs in a mass-spectroscope [Abstr. 409 (1948)] can be released as gas by heating in vacuo. Sufficient pure Ne^{20} was isolated by 1 hr running at 40 μA current to fill a Geissler tube for obtaining spectra.

539.155.2 : 539.152.1 2177

Mass-defects of the heavy isotopes. WAPSTRA, A. H. *Nature, Lond.*, **161**, 529–30 (*April* 3, 1948).—Errors in Flugge and Mattauch's "Isotopenbericht 1942" [*Phys. Z.*, **44**, 181 (1943)] are pointed out, and corrected tables provided, relative to Pb^{206}. The adjustment of the Th, Ac and Np families to the U family is explained; a special diagram was used for the Ac and Np families, in which the difference of the mass defects from a well-chosen linear function of the mass-number A is written against each point of an A *v.* n diagram (n = neutron defect). This permits study of the energy surfaces in greater detail than hitherto.

539.155.2 : 539.163 2178

Considerations on the existence of element 61 in nature. BALLOU, N. E. *Phys. Rev.*, **73**, 630 (*March* 15, 1948).—Calculations based on the Bohr–Wheeler theory show that all possible isotopes of element 61, with the exception of 61^{145}, are unstable with respect to β-decay by at least 1 MeV. It is suggested that isotope 61^{145} may be produced by the β-decay of Nd^{145}, and is likely to be a fairly long-lived α-emitter. In this connection, experiments have shown that the observed α-activity of Sm samples is not due to this isotope. Further work to be done includes the production of 61^{145} by the irradiation of highly purified Sm with slow neutrons. R. W. P.

RADIOACTIVITY . NUCLEAR DISINTEGRATION NUCLEAR PARTICLES 539.16/.18

539.16.08 = 4 2179

Note on the measurement of activity of radioactive preparations. GUÉBEN, G., GOVAERTS, J., AND STOPPANI, A. D. *Ann. Soc. Sci. Brux.*, **61** (*Sér.* 1) 250–5 (*Dec.* 12, 1947) *In French.*—The correction for self-absorption o thick sample is discussed. A semi-logarithmic plot specific activity *v.* thickness is recommended, as this gi a straight line which can be accurately extrapolated ba to zero thickness. A. P.

539.16.08 : 539.166 *see Abstr.* 2189

539.163 : 539.155.2 *see Abstr.* 2178

539.163.1 : 539.172.4 *see Abstr.* 2202

539.163.2 21

The relative energies of the gamma-radiation fr Co^{60} and Zn^{65}. JENSEN, E. H., LASLETT, L. J., AND PRA W. W. *Phys. Rev.*, **73**, 529 (*March* 1, 1948).—Gamm ray energies are reported: for Co^{60} of 1·16 and 1·32 Me and for Zn^{65} of 1·11 MeV. Measurements were ma with a thin-lens magnetic spectrograph, using the phot electrons ejected from a thin Pb foil. A source with bo activities gave a composite spectrum which confirm that the γ-ray from Zn^{65} is of lower energy than either the Co^{60} γ-rays. R. W.

539.163.2 21

The beta-spectrum of Au^{198}. SAXON, D. *Phys. Re* **73**, 811–12 (*April* 1, 1948).—A source 0·4 mg/cm² Au (nylon backing 0·54 mg/cm²) was used in a 18 β-spectrometer with G.M. counter registration (nyl window 0·3 mg/cm²). The β-spectrum shape and t Kurie plot are given, the extrapolated Kurie end poi being $0{\cdot}960 \pm 0{\cdot}005$ MeV. The linearity of this pl back to 0·2 MeV suggests an allowed transition, but t observed end point leaves Au^{198} in the second forbidd classification. It is pointed out that the observ allowed shape cannot be explained as the sum of two more forbidden spectra as the ratio of β-γ coincidenc to β's is constant up to 0·7 MeV. An estimate of t neutrino mass from the Kurie plot data near the e point gives $\nu \leqslant 15$ MeV or $\nu \leqslant 0{\cdot}03 \times$ the electr mass. Observed K and L conversion peaks give a γ-r energy of 0·4 MeV with conversion coefficients $\sim 1\%$. R. W.

539.163.2 21

Internal conversion electrons from 70-day Ir^{192}. HU R. D., AND MEYERHOF, W. E. *Phys. Rev.*, **73**, 812– (*April* 1, 1948).—Measurements with a high-dispersio 180° photographic β-ray spectrograph in the energy ran up to $\sim$300 MeV, have permitted the identification γ-rays from 70-day Ir^{192} of energy 137 MeV (K, L_1 a L_{111} conversions), 208 MeV (K, L_1, L_{111}, M, N), 296 Me (K, L_1, L_{111}, M, N), 308 MeV (K), 317 MeV (K). comparison is made with the work of Levy and of Co [Abstr. 3627–8 (1947)]. R. W.

539.163.2 = 4 21

Complexity of the alpha-radiation from protoactiniu ROSENBLUM, S., AND COTTON, E. *C.R. Acad. Sci., Pari* **226**, 171–3 (*Jan.* 12, 1948) *In French.*—The fine structu of α-particle energies was studied, using a permane magnet spectrograph, with photographic plates f detection. The chief groups occur at 5·032, 5·069 an 5·131 MeV. A. P.

539.163.2 : 537.133 21

Apparent emission of positive electrons from β-emitter MCCUSKER, C. B. A. *Nature, Lond.*, **161**, 564–5 (*April* 1 1948).—Cloud-chamber photographs of tracks from Ra and Ra(D and E) sources with and without magneti field showed that the tracks of positrons previous reported [Abstr. 179 (1948)] are in fact due to erroneo curvature by multiple scattering [Abstr. 989 (1947)].

163.2 : 539.152.1 2185
pin-dependence of magnetic dipole gamma radiation the nuclear level scheme of Pb^{208}. RICHARDSON, O. W. *Nature, Lond.*, **161**, 516–18 (*April* 3, 1948).— e alternative level schemes are suggested for Pb^{208} D). The interpretation is aided by the observation the *G* and *L* γ-rays have a high coefficient of internal version in the *K*-shell, and thus have a high proportion nagnetic dipole radiation; the *M* γ-ray is probably e electric quadrupole radiation. The levels should all e the same parity value (internal conversion too large electric dipole rays); the *G* and *L* rays have a change uclear spin quantum number 0 or $\pm$ 1, the *M* ray [see Abstr. 3137 (1936)].

.164.08 : 537.542 = 3 *see Abstr.* 2139

.164.08 : 548.0 2186
onductivity pulses induced in single crystals of zinc hide by alpha-particle bombardment. AHEARN, A. J. *s. Rev.*, **73**, 524 (*March* 1, 1948).—The use of ZnS crystal counter is described. Performance is inferior hat of the best diamond counters. A. P. F.

).165.2 2187
revised Sargent diagram. FEATHER, N. *Nature, id.*, **161**, 431–2 (*March* 20, 1948).—A diagram of ctive bodies in the atomic number range 81–93, ilar to the author's earlier diagram [Abstr. 1949 38)] but containing newly available information, is sented, and its features discussed. A new line on the gram is pointed out, which necessitates reassignment the orders of the lines.

).165.2 : 539.152.1 2188
The energy and momentum relations in the beta-decay, d the search for the neutrino. CRANE, H. R. *Rev. Mod. ys.*, **20**, 278–95 (*Jan.*, 1948).—A comprehensive survey recent work (54 references). The energy relations in e β-decay have been well established experimentally, e mass of the neutrino having been shown to be $\ll$ that the electron if not zero. More sensitive measurements mass are possible, especially in cases where the spectrum energies are small. Experiments with very gh energy β-spectra (e.g. B^{12}) are likely to be of interest. ne non-conservation of momentum in β-decay has been equately shown, and future experiments will be con- rned with the determination of the neutrino-electron gular correlation functions. Sherwin's experiments bstr. 1312 (1948)] mark a notable advance. The ntinued development of the technique introduced by llen [Abstr. 2642 (1942)] is recommended, however, to btain conclusive evidence as to whether or not the recoil oms are monoenergetic. The subject of neutrino sorption is discussed. R. W. P.

).166 : 539.16.08 2189
Studies of self-absorption in gamma-ray sources. VANS, R. D., AND EVANS, R. O. *Rev. Mod. Phys.*, **20**, 25–26 (*Jan.*, 1948).—A theoretical and experimental aluation of the self-absorption corrections in sources of lindrical geometry. The effect of absorption in the alls of a cylindrical container is also considered. orrection terms are deduced for use with Ra γ-ray andards. Other topics discussed include the two-vial chnique of estimating self-absorption, the influence of ne quantum efficiency of the detector, and the assay of a-bearing materials by the γ-ray method. R. W. P.

39.166 : 539.174 2190
Gamma radiation from excited states of light nuclei. OWLER, W. A., LAURITSEN, C. C., AND LAURITSEN, T. *ev. Mod. Phys.*, **20**, 236–77 (*Jan.*, 1948).—An extensive iscussion of problems associated with energy and yield measurements of these γ-rays. Deals particularly with the resonances in γ-ray emission from Li^7, Be^9, C^{12}, N^{13}, C^{13} and F^{19} under proton bombardment with an energy spread of < 300 eV at 1 MeV. Excitation curves, resonance energies and widths, radiation energies, target yields and absolute cross-sections are given. The work includes an extension of the calculations of Bleuler and Zünti on counter efficiency to higher energy radiation, and a comparison of the results with similar calculations on electroscopes. Consideration is given as to how far the present measurements permit the assignment of the spectroscopic character of the excited states of nuclei. R. W. P.

539.166.08 : 548.0 : 549.211 2191
Remarks on diamond crystal counters. HOFSTADTER, R. *Phys. Rev.*, **73**, 631 (*March* 15, 1948).—The observation that type II diamonds (transparent to ultraviolet) make better γ-ray counters than type I is explained by the theory that type II are laminated and type I mosaic, the further assumption being made that electrons freed by the radiation are trapped on reaching the boundary of a lamina or of an element of the mosaic. It is predicted that type II diamonds will make the best counters when oriented so that the electric field is || to the laminations. A. J. C. W.

539.166.2 2192
Polarization correlation of successive gamma-ray quanta. FALKOFF, D. L. *Phys. Rev.*, **73**, 518 (*March* 1, 1948).—The polarization distribution is given in the form $W(\phi) = 1 + A \cos 2\phi$, ϕ being the angle between the polarizations of the two quanta. The magnitude of A depends on the nuclear spins, but its sign depends also on the electric or magnetic multipole character. It is pointed out that whenever an angular correlation of γ-ray quanta emitted in successive nuclear disintegrations is easily measurable one may also expect an appreciable correlation in polarization. R. W. P.

539.169 2193
Chemical effects of ionizing radiations. STEIN, G., AND WEISS, J. *Nature, Lond.*, **161**, 650 (*April* 24, 1948).—The products obtained by irradiating simple organic compounds with X-rays and neutrons are found to confirm the belief [Abstr. 296 (1945); 444 (1948)] that the primary action of these radiations on aqueous systems is the production of hydroxyl radicals.

539.17 = 3 2194
On the theory of the mass distribution function of the fission fragments from spontaneous disintegrations. BAGGE, E. *Z. Naturforsch.*, **2a**, 565–8 (*Oct.*, 1947) *In German.*—An explanation is given of the spontaneous fission of U into unequal fragments. A formula for the penetration of the potential barrier leading to fission is given, containing the reduced mass of the two particles; it is therefore sensitive to their mass ratio. Splitting into equal parts is least likely, whilst the Coulomb forces prevent splitting into parts of widely different masses. The maximum probability is in the mass range given by experiments. G. J. K.

539.17 : 535.822 : 535.313 2195
Applications of the reflecting microscope to the nuclear plates technique. BATES, W. J., AND OCCHIALINI, G. P. S. *Nature, Lond.*, **161**, 473 (*March* 27, 1948).—The long working distance of the reflecting microscope [Abstr. 854 (1947)] enables emulsions to be examined through the backing plate. Thus the bottom side of "stars" could be examined, and also tracks which traverse both emulsions of two plates placed face to face. In the latter, the air gap between the two, and the extra emulsion thickness, gave an extended range.

539.17 : 537.591.8 *see Abstr.* 2156

539.172 2196

Proton widths of light nuclei. CHRISTY, R. F., AND LATTER, R. *Rev. Mod. Phys.*, **20**, 185–90 (*Jan.*, 1948).—The energy-dependent factors in the width of resonance lines in nuclear reactions promoted by protons are calculated and plotted for light nuclei from Li^7 to F^{19}.

G. J. K.

539.172 2197

Note on angular distributions in nuclear reactions. WOLFENSTEIN, L., AND SACHS, R. G. *Phys. Rev.*, **73**, 528 (*March* 1, 1948).—A slight correction to an argument presented in an earlier paper [Abstr. 405 (1948)] for reactions yielding a number of particles of arbitrary spin.

A. P. F.

539.172 = 4 2198

Observation of an almost complete disintegration of a silver nucleus. LEPRINCE-RINGUET, L., HEIDMANN, J., HOANG, T.-F., JAUNEAU, L., AND STROUMSA, J. *C.R. Acad. Sci., Paris*, **225**, 1144–6 (*Dec.* 10, 1947) *In French.*—A complex "star," showing 24 charged particle tracks (comprising ~40 units of charge) was found in a photographic plate exposed at high altitude. From considerations of momentum and energy, the mass of the particle causing the disintegration is estimated to be between 0·31 and 15 × mass of a nucleon.

A. P. F.

539.172 : 537.591 : 550.42 2199

Production of helium by cosmic rays. HUNTLEY, H. E. *Nature, Lond.*, **161**, 356 (*March* 6, 1948).—Photographic plates exposed for 6 weeks at 11 000 ft altitude showed a minimum number of 15 000 nuclear disintegrations per cm^3 originating in the glass. If only one α-particle is produced per disintegration, He is produced in the glass at the rate of 10^5 atoms/cm^3/yr. The most abundant minerals on the earth have an atomic composition similar to glass, and any arguments based on their He content must take account of the above.

539.172 : 537.591.8 2200

Disintegration of highly excited nuclei. PERKINS, D. H. *Nature, Lond.*, **161**, 486–7 (*March* 27, 1948).—[See Abstr. 3645 (1947)]. Detailed measurements of angular distributions of emitted particles were made on 24 photo-emulsion "stars," each involving emission of 15–22 charged particles from AgBr or I nuclei, and produced by cosmic rays. The protons appear to be emitted symmetrically, but the α-particles tended to be emitted in the opposite direction to the heavy fragments. These results are discussed on the "evaporation" theory. The excitation energy involved in these disintegrations is estimated at 500–1 000 MeV, and the different nature of the process from that with slower particles [Abstr. 2204 (1948)] is pointed out. Possibly these are due to inelastic scattering of very fast cosmic-ray particles, and not capture of neutrons or mesons.

539.172.4 2201

Fission products of U^{233}. GRUMMITT, W. E., AND WILKINSON, G. *Nature, Lond.*, **161**, 520 (*April* 3, 1948).—A table is given of the yields and identification of 31 active isotopes resulting from U^{233} and U^{235} fission (mass numbers 89 to 147). The yield of Ba^{140} from U^{235} fission in natural U was taken as a reference. The yield curve shows a double hump as with U^{235}, but the groups are one unit lower on the mass scale. The maxima are approx. the same in all cases, $\sim 6 \times 10^{-2}$.

539.172.4 : 539.163.1 2202

Long life zirconium from uranium 235 fission. GROSSE, A. V., AND BOOTH, E. T. *J. Amer. Chem. Soc.*, **70**, 465–6 (*Feb.*, 1948).—An isotope of Zr, having a ½-period of 66 days, and one of 17 hr ½-period occur in U fission products. Other Zr isotopes are predicted.

W. R.

539.174 : 539.166 *see Abstr.* 2190

539.174 : 539.185 22

Interaction of fast neutrons with indium. COHEN, S. *Nature, Lond.*, **161**, 475–6 (*March* 27, 1948).—Cur showing variation with energy of cross-section of In for production of (*a*) metastable In^{115*} (4½-hr) by (*n*, process and (*b*) In^{116} (54 min) by neutron capture shown. The threshold for the former is proba ~1 MeV, and the cross-section is constant abo 2·2 MeV. The latter falls steadily with increasing neutr energy. The cross-section for the excitation of In^{113*} a (*n*, *n*) process is of the same order of magnitude.

539.18 22

Production of mesons by the 184-inch Berke cyclotron. GARDNER, E., AND LATTES, C. M. G. *Scien* **107**, 270–1 (*March* 12, 1948).—Numerous trac identified as meson tracks, were found in photograp emulsions exposed near C and other targets bombarc by 380-MeV α-rays. About ¾ of the tracks ended stars, and the total intensity of the mesons $\simeq 10^8 \times$ tl available in cosmic rays. The mass, determined bending in the cyclotron magnetic field, was 313 ± 16 and these negative mesons are therefore identified w the heavy mesons of Lattes *et al* [Abstr. 417 (1948 The yield was very much less at 300 MeV, and it estimated that, in the experiments, up to 195 MeV w available for the production of the particles, which cou have occurred through nucleon-nucleon collisions.

539.18 22

The artificial production of mesons. OCCHIALI G. P. S., AND POWELL, C. F. *Nature, Lond.*, **161**, 551 (*April* 10, 1948).—Measurements of small-angle scatteri of π- and σ-mesons [Abstr. 417 (1948)] from tracks photographic emulsion show that they have a ma identical with those obtained artificially by bombardme of C, Be, Cu and U by fast α-particles [Abstr. 22 (1948)].

539.18 22

A new method for the determination of the mass mesons. POWELL, C. F., AND ROSENBLUM, S. *Natu Lond.*, **161**, 473–5 (*March* 27, 1948).—Tracks can identified which start in the emulsion of one, and e in the other, of two photographic plates placed with th emulsions facing each other 3 mm apart in a magne field [Abstr. 2195 (1948)]. The way in which parti mass may be estimated from measurements on su tracks is described; accuracy may be as good as 10%.

539.18 22

The mass of σ-mesons. LATTIMORE, S. *Nature, Lon* **161**, 518–19 (*April* 3, 1948).—A new method of measuri the curvature of tracks in photographic emulsion due Coulomb scattering is described; the angles betwe successive chords are measured instead of betwe tangents. It has been applied to scattering/residual ran calculations on 315 σ-meson tracks [Abstr. 417 (1948 The mean mass was found to be 290 ± 80 electr masses, and though the method would not be able resolve the masses into distinct groups, if such existe it can be said that if any appreciable number have ma 200, a corresponding number must have mass > 400.

539.18 : 537.591.5 *see Abstr.* 2154

539.185 : 537.534.74 22

Neutron-proton scattering at 100 Mev. EISENSTEIN, AND ROHRLICH, F. *Phys. Rev.*, **73**, 641 (*March* 15, 194

esults are quoted for the cross-section, with rec- ular potentials of many types, central or non-central, Yukawa potentials. They lie near $1{\cdot}1\times10^{-24}$ cm², re rather higher, which > than the present experi- tal value at 90 MeV, with a slight preference for a metric theory. The measured ratio of 90° to back- ds scattering does not agree with any published lts, but it is suggested that tensor forces are needed xplain it. G. J. K.

185 : 537.534.74 : 530.145 *see Abstr.* 2013

185 : 539.174 *see Abstr.* 2203

185 : 548.74 2209

aue photography of neutron diffraction. WOLLAN,)., SHULL, C. G., AND MARNEY, M. C. *Phys. Rev.*, 527–8 (*March* 1, 1948).—Laue photographs were taken g a collimated beam of thermal neutrons with a elength distribution from 0·5 to 3·0 Å, taken from Clinton pile. Photographic detection was accom- ied by inserting a sheet of In 0·5 mm thick between beam and the film and in contact with the film, the articles from the In producing the required photo- hic effect. The film was backed by a ¼-in B carbide tic shield, and both the In sheet and the plastic shield e holes cut in them to permit passage of the primary m. This beam was ¼ in. in dia. on leaving the pile. A tograph of a crystal of NaCl 0·35 cm thick is re- duced (exposure time 10 hours). The relative nsities of the spots are in agreement with those ected from the intensity distribution in the neutron ctrum of the incident beam. Laue photographs are obtained for other crystals, including quartz, calcite, and $NaNO_3$. J. T.

STRUCTURE OF SOLIDS 539.2

.211 : 537.364 *see Abstr.* 2127

.211 : 669 : 548.5 *see Abstr.* 2246

.214 : 539.217 2210

Viscous slip along grain boundaries and diffusion of zinc alpha-brass. Kê, T'-S. *J. Appl. Phys.*, **19**, 285–90 *arch*, 1948).—The viscous behaviour of the grain ndaries in 70–30 α-brass was demonstrated by lastic measurements. It was shown that the grain ndaries cannot sustain permanently a shear stress and e a coefficient of viscosity decreasing with an increase temperature. Using the same α-brass specimen, the ivation energy associated with the stress-induced ferential orientation of pairs of Zn atoms in α-brass hich is a diffusion process) was determined. This ivation energy was found to be identical, within perimental error, with the activation energy associated h the grain boundary slip in α-brass. This indicates t the slip in α-brass is a diffusion process and the usion mechanism is similar to the volume diffusion in rass. A.

7.215.4 2211

Dark-field electron microscopy. II. Studies of colloidal bon. HALL, C. E. *J. Appl. Phys.*, **19**, 271–7 (*March*, 48).—Several commercial carbon blacks were examined h dark-field illumination in the electron microscope. omalous intensities in the dark-field images are erpreted as resulting from coherent scattering by rallel layer groups of graphitic planes, which were viously identified by Biscoe and Warren [Abstr. 2401 42)] using X-ray diffraction. The dark-field micro- phs indicate that in a non-reinforcing and a semi- nforcing black, the parallel layer groups near the face of the roughly spherical particles are oriented with their representative vector approx. normal to the surface. No definite evidence was obtainable for such an arrangement in a reinforcing channel black with average particle diameter ~300 Å. After prolonged heat treatment to the point where graphitization occurs the channel black exhibits numerous diffraction images in dark-field, indicating the presence of crystals with dimensions in the range 20–90 Å. A.

539.215.4 : 535.43 : 535.341 : 531.724 *see Abstr.* 2024

539.215.4 : 537.531 : 539.25 = 4 2212

Small angle X-ray scattering and electron microscopy. BRUSSET, H. *C.R. Acad. Sci., Paris*, **225**, 1002–3 (*Nov.* 24, 1947) *In French.*—Six samples of C black were examined by the small-angle scattering of X-rays and by electron microscopy. In each case the samples were arranged in the same order with respect to size, but the sizes determined by electron microscopy were several times > those found from X-ray measurements. It is concluded that in electron microscopy the particles usually observed are aggregates. J. T.

539.217 : 539.214 *see Abstr.* 2210

539.217.5 : 533.15 = 4 *see Abstr.* 2035

539.23 : 548.5 *see Abstr.* 2247–8

539.25 : 537.531 : 539.215.4 = 4 *see Abstr.* 2212

539.26 : 669.1 2213

X-ray analysis in the steel industry. WILSON, A. J. C. *J. Sci. Instrum.*, **24**, 266–74 (*Oct.*, 1947).—A report of papers presented at the 1946 autumn meeting of the X-ray Analysis Group of the Institute of Physics. **Intensity relations of Debye–Scherrer powder diffraction lines.** BRADLEY, A. J. The contributions of geometrical and photographic effects and of the natural inhomogeneity of X-rays to line breadths are analysed, particularly in the special case of annealed wires 0·03 cm thick in a 19-cm dia. camera. The visual appearance of the lines is correlated with their photometer curves. **Application of X-rays to the study of internal stresses and deformation in metals.** WOOD, W. A. A special test piece is used that can be photographed while subjected to a known macroscopic stress. The stress-strain curve of the actual lattice is thereby obtained, and the disruption of the metal into crystallites can be followed. On the removal of a macroscopic stress > the yield point for the crystallographic plane examined, a permanent lattice contraction remains. **An X-ray diffraction investigation of electrodeposited chromium.** GOLDSCHMIDT, H. J. In good hard-wearing Cr plate the lattice of the Fe base is expanded by absorbed H and the Cr is deposited on a lattice continuous with that of the base. In bad plating this linkage is not present. The high strains set up in the plating and the base by the linkage are the cause of the hardness and wear-resistance. **Some successes and failures in the application of X-rays to industrial problems.** JAY, A. H. Failures occurred in the observation of graphite in cast iron, the determination of the SiO_2 content of ZrO_2 flour within ½%, the detection of poorly crystalline components (e.g. geothite) in iron ores, and in the explanation of temper-brittleness of Ni–Cr steels. Successes were obtained in connection with chrome-magnesite bricks, carbon steels, calcined dolomite products, fireclay, and the constitution of slags. **The surface structure of metals.** FINCH, G. I. Electron diffraction examines the surface layer (~15 atoms thick), X-ray diffraction the main body, so that the methods are complementary. Electron diffraction has been used to investigate polish layers, worn pistons and piston rings, and the orientation of deposited layers. The discussions

following the papers are in some cases critical of the speakers' views. A. J. C. W.

ELASTICITY . STRENGTH . RHEOLOGY 539.3/.8

539.319 : 535.551 : 548.0 2214

Photo-elastic investigation of internal stresses in silver chloride caused by plastic deformation. Nye, J. F. *Nature, Lond.*, **161**, 367–8 (*March* 6, 1948).—Photographs are published showing the pattern of fringes visible between crossed Nicols with thin strips (0·3 to 1 mm) of annealed rolled polycrystalline AgCl after plastic deformation. The form and meaning of the fringes are discussed. An explanation is also given of the visibility of the grain boundaries during elastic bending between crossed Nicols.

539.32 2215

A determination of the elastic constants for beta-quartz. Kammer, E. W., Pardue, T. E., and Frissel, H. F. *J. Appl. Phys.*, **19**, 265–70 (*March*, 1948).—The complete set of adiabatic elastic constants for β-quartz were obtained for a temp. range of 580°–800°C. The elastic moduli were computed from the elastic constants and are compared with the adiabatic and isothermal values which have been determined by others. A.

539.32.098 : 538.65 *see Abstr.* 2165

539.37 : 537.323.091 = 4 *see Abstr.* 2124

539.374 2216

A coefficient of viscous extension. Swainger, K. H. *Nature, Lond.*, **161**, 650–1 (*April* 24, 1948).

539.389.3 : 539.434 2217

On creep and relaxation. II. Gross, B. *J. Appl. Phys.*, **19**, 257–64 (*March*, 1948).—[See Abstr. 1637 (1947)]. A phenomenological theory of the elastic after-effect can be formulated with the aid of the principle of superposition. The theory of the steady-state behaviour under alternating load and deformation is given. Relations are established between the loss factor, the storage factor, the distribution functions, and the Laplace transforms of the creep—and the relaxation—function. A.

539.389.3 : 666 2218

The influence of delayed elasticity on the rate of annealing of glass. Jones, G. O. *J. Soc. Glass Tech.*, **31**, 218–27 (*Oct.-Dec.*, 1947).—Reasons for departure from exponential or "Maxwellian" law of rate of annealing (rate of release of stress) of glass are discussed. It is shown that delayed elasticity has an important influence, sufficient to account for anomalies previously existing in the theory of annealing. Numerical examples are given; quantitative estimate is difficult with present exp mental data on account of possible "freezing-in" delayed elastic effects. Anomalies in previous work discussed in some detail. G. (

539.389.3 : 666 2

Annealing of glass. Cox, S. M. *Nature, Lond.*, 1 401–2 (*March* 13, 1948).—The departure of st relaxation of glass during annealing from the Maxwel formula is discussed, and an alternative formula suggested. The release of stress is attributed to chan in the equilibrium condition of the glass under the act of the stresses present. [See Abstr. 2218 (1948)].

539.4.016.2 : 537.312.9 2

The disordering of β-brass by cold work. Honeycon R. W. K., and Boas, W. *Nature, Lond.*, **161**, 612 (*April* 17, 1948).—Wires containing approximately eq amounts of α- and β-brass were cold drawn to reducti in area up to 95·5%. The electrical resistance sho evidence of disordering of the β-brass above ~9 reduction. Some re-ordering took place with time room temp. The change of resistivity of α-brass v working is of interest.

539.4.016.2 : 538.27 *see Abstr.* 2163

539.434 : 539.389.3 *see Abstr.* 2217

539.434 : 679.5 : 620.172.224 2

The constant stress apparatus for the study of the cr properties of plastics. Ward, A. G. *J. Sci. Instr. Phys. Ind.*, **25**, 147–51 (*May*, 1948).—[Abstr. 162 (1948)].

539.501 2

The plastic flow of thick-walled tubes with large stra MacGregor, C. W., Coffin, L. F., Jr., and Fisher, J *J. Appl. Phys.*, **19**, 291–7 (*March*, 1948).—The theor discussed for a material having an arbitrary t stress/strain curve, loaded by any combination of inter pressure, external pressure, and end load, where strains may become large necessitating the use of fi true strain definitions. Comparisons are made of finite strain theory, the infinitesimal strain theory, a experimental results for the special case of a closed-e thick-walled Al tube. The comparison shows that infinitesimal strain theory is considerably in error e at moderate strain values. The finite strain the appears to be satisfactory even for strains somew beyond the value for the local bulging of thick-wal tubes.

539.501 : 532.5 *see Abstr.* 2028

PHYSICAL CHEMISTRY 541

REACTION KINETICS 541.124/.128

541.126 2223

Birth and growth of the explosion in solids initiated by impact. Bowden, F. P., and Gurton, O. A. *Nature, Lond.*, **161**, 348 (*March* 6, 1948).—Solid explosives, in the form of film, have been shown to exhibit an initial comparatively slow rate of propagation, suddenly transforming to a much faster rate at a small distance from the point of initiation, as with liquid explosives [Abstr. 3704 (1947)].

541.126 2224

Initiation of explosives by adiabatic compression of their own vapour. Yoffe, A. *Nature, Lond.*, **161**, 349 (*March* 6, 1948).—The increase of explosion efficiency on impact caused by the presence of small gas inclusions [Abstr. 1337 (1947)] is shown to be largely unaffected by the pressure of air, and at low pressures is t probably due to the compression of the vapour of explosive (Nitroglycerine 10^{-3} mm, P.E.T.N. 10^{-4} Hg). This assumes that the vapour is not condensed the rapid compression.

541.126 2

Initiation of high explosives. Herzberg, G., Walker, G. R. *Nature, Lond.*, **161**, 647–8 (*April* 1948).—Using a rotating mirror camera with image sp of 2 km/sec, photographs were obtained of the explos of solid explosives in which the point of initiation of explosion is several mm away from the detona Apparently the detonator initiates a low-order wave wh changes subsequently to a high-order wave. In t charges the change may take place in several localit giving several unconnected explosion waves.

128 2226
urface catalysis. BEECK, O. *Rev. Mod. Phys.*, **20**, -30 (*Jan.*, 1948).—A review of the work of the author his associates in this field. In much of the work a ecular beam of the reactant impinged on the heated ace of the catalyst, and the change in pressure was l on a very sensitive Pirani gauge. Saturated, dry rocarbons first decomposed at 1 600°, but a trace of) or H_2S caused decomposition at much lower tem- atures. Polymerization of olefines and ethylenes was lied. Using films of metals deposited on glass, it was nd that the lattice spacing was of critical importance ydrogenation reactions, though lattice distortion may be significant in the more complicated catalysts. ay, electrodiffraction, magnetic and radioactive tracer hods are briefly discussed. S. J. G.

ELECTROCHEMISTRY 541.13

.133.1 2227
simple moving-boundary apparatus. BAXTER, E. G., GOLD, V. *Nature, Lond.*, **161**, 403 (*March* 13, 1948).

PHOTOCHEMISTRY 541.14

.143 : 541.183.5 : 772.1 2228
Reversible photolysis of Ag sorbed on colloidal metal des. GOETZ, A., AND INN, E. C. Y. *Rev. Mod. Phys.*, 131–42 (*Jan.*, 1948).—Ag, as Ag_2O, sorbed on ZnO d on TiO_2 as anatase and rutile (all finely divided, cific area $\sim 5\ m^2/g$) is photosensitive. The photo- sitivity was obtained in terms of the reflectivity for ttered light measured by a photo-cell, compared with t of a cast plaster-of-paris plate as standard, with Hg illumination. The preparations are not sensitive in absence of moisture. They give excellent photo- phic images, strong in contrast; the final colour of the posed material varies between black and yellowish, pending on the particle size of the substrate. The ectral sensitivity declines in the same region as for Ag lides, viz. $\sim 4\ 500$ Å. The Ag is probably chemisorbed AgOH; the blackening effect increases with increasing ncentration of Ag till the latter reaches the amount quired to form a complete monolayer of Ag on the rface of the substrate particles. The blackening is due reduction of Ag^+ to Ag, and can be reversed by onized O_2, or by H_2O_2. Probably reduction is limited the AgOH present in the top layers of the particles, t more Ag then migrates from the centres of Ag pply—either unsorbed Ag_2O or sorbed Ag_2O from the yers underneath—so that a very large amount of reduced g can ultimately be collected on the exposed surface. S. J. G.

OLLOIDS . DISPERSE SYSTEMS 541.18/.182

41.18.043 2229
Principle of a counter-streaming centrifuge for the paration of particles of different sizes. LINDAHL, P. E. *ature, Lond.*, **161**, 648–9 (*April* 24, 1948).

41.182.2/.3 : 533.6.01 = 3 *see Abstr.* 2037

41.182.63 : 537.363 = 4 *see Abstr.* 2126

ADSORPTION 541.183

41.183 : 532.516 2230
Adsorption and lubrication at crystal surfaces. I. On he boundary lubrication of sodium nitrate. HUTCHINSON, ., AND RIDEAL, E. K. *Trans. Faraday Soc.*, **43**, 435–8 (*July*, 1947).—The coefficient of friction μ of $NaNO_3$ against $NaNO_3$ and of NH_4NO_3 against NH_4NO_3 was measured by a rotating disc method, lubricated with solutions of varying concentrations c, of various surface-active substances, S, in nitrobenzene (speed 2–12 cm min^{-1}). For stearic acid, stearoxyacetic acid, ammonium stearate, ammonium oleate and cetyl alcohol μ is a function of c and of S, but falls in all cases to $\mu \simeq 0{\cdot}12$ at $c \simeq 2\ mg/cm^3$. A low molecular weight polymer gave $\mu = 0{\cdot}16$, but showed better wearability, probably because its molecule was attached to the crystal surface by several points instead of by one only as in the long chain lubricants. S. J. G.

541.183 : 532.516 2231
On adsorption and lubrication at crystal surfaces. II. On the adsorption of paraffin chain compounds on sodium nitrate. HUTCHINSON, E. *Trans. Faraday Soc.*, **43**, 439–42 (*July*, 1947).—The adsorption isotherms from solution in organic solvents of various long chain materials (e.g. stearic acid and octadecyl alcohol) on nitrate crystals were determined by the Langmuir trough technique. The course of the isotherm varied slightly according to the solvent used, and varied markedly from one adsorbate to another. The curves of (fractional surface covering, θ) *v.* (lowering of friction) are of the same order as those of θ *v.* concentration, i.e. the order of efficiency as lubricants is the same as that of the ease of adsorption. S. J. G.

541.183 : 532.516 : 536.658 2232
Adsorption and lubrication at crystal surfaces. III. On heats of wetting and adsorption on ionic crystals. HUTCHINSON, E. *Trans. Faraday Soc.*, **43**, 443–7 (*July*, 1947).—The heat of wetting of powdered NaF in a number of liquids (including CCl_4, C_6H_6 and oleic acid) was determined with a Dewar flask as calorimeter vessel; using a thermistor, instead of a Beckmann thermometer, the rise in temperature can be measured within 0·001°. The surface area of the powder was determined by maximum adsorption of stearic acid. Heats of wetting varying between 0·33 and 0·96 cal/g for different powders, and between 8·1 and 24·7 k cal/mole for different liquids were obtained. Heats of adsorption from solution (mainly in benzene) of several adsorbates were also measured, and also heats of mixing with benzene of several of the adsorbates. S. J. G.

541.183 : 532.613.4 = 4 2233
Influence of temperature on adsorption at interfaces. Liquid paraffin activated by stearic acid. TRILLAT, J. J. AND BRIGONNET, J. *C.R. Acad. Sci., Paris*, **225**, 1005–7 (*Nov.* 24, 1947) *In French.*—Very small quantities of stearic acid were added to a pure, non-polar oil. The lowering of the interfacial tension (I.T.) of the activated oil against distilled water as a function of time and temperature (20°–65°C) was measured by means of a du Noüy tensiometer which was modified to record automatically. At a particular temp. the curve relating the relative I.T. to time shows a sharp drop immediately after the interface is formed. This is followed by a gradual approach to a steady value. As the temp. is raised the ultimate steady value is higher but is reached more quickly. A straight line relates the time necessary to reach equilibrium to temp., while the curve relating the ultimate lowering of I.T. to temp. is exponential. The results obtained with the automatic recording device, giving relative values of I.T., were checked by measurements of absolute I.T. where the ring of the tensiometer is detached from the interface. J. I.

541.183.5 : 772.1 : 541.143 *see Abstr.* 2228

CHEMICAL STRUCTURE 541.4/.6

541.5/.6 : 535.345.1 2234

Opacity changes during the sol-gel transformation of soap-pinene systems. HATTIANGDI, G. S. *Proc. Indian Acad. Sci. A*, **27**, 23–8 (*Jan.*, 1948).—Changes in opacity were measured at different time intervals. At high concentrations of soap the curves are S-shaped, whilst for low soap concentrations a distinct change in shape occurs after the S-shaped stage is reached. Na oleate and Na stearate gels in pinene give similar curves, but Na palmitate in pinene shows constant opacity throughout gel formation. A correlation between opacity data and change in number, size, and degree of solvation of colloid particles during gelation is attempted. W. R. A.

CHEMICAL ANALYSIS 543/545

545.7 : 533.5 : 621.384 2235

Electronics simulates sense of smell. WHITE, W. C., AND HICKEY, J. J. *Electronics*, **21**, 100–2 (*March*, 1948).—[Abstr. 1777 B (1948)].

545.7 : 614.838.14 2236

The design, testing and calibration of a combustible-gas detector. POOLE, R. *J. Instn Elect. Engrs, Pt II*, **95**, 258–74 (*June*, 1948).—[Abstr. 1621 B (1948)].

545.71 : 532.57 2237

Mercury slug flowmeter. YUDOWITCH, K. L. *Analyt. Chem.*, **20**, 86 (*Jan.*, 1948).—Small gas flow rates are measured with a pressure drop of < 3 mm of Hg with the instrument described. A Hg slug traverses a very slightly dished glass spiral, and is replaced by a fresh one as it leaves; cycles can be counted electrically. It operates from 2–76 cm of Hg.

545.82 : 535.343.4–15 2238

Determination of small amounts of water in gases and liquids by infrared spectrometry. BENNING, A. F., EBERT, A. A., AND IRWIN, C. F. *Industr. Engng Chem. (Analyt. Edit.)* **19**, 867–8 (*Nov.*, 1947).—A method is presented for the rapid determination of minute quantities of water in various solvents by measurement of the infrared absorption of a sample contained in a pressure absorption cell. Concentrations of water as low as 1 p.p.m. can be determined in a number of commercial refrigerants. A.

545.822 : 621.38.032.216 2239

A method of spectrographic analysis of impurities in materials for oxide coating of thermionic cathodes. ORGAN, T. J., AND PARSONS, S. L. *J. Opt. Soc. Am* **38**, 191–5 (*Feb.*, 1948).

545.824 : 537.531 : 535.34 2

Chemical analysis based on X-ray absorption measu ments with a multiplier phototube. LIEBHAFSKY, H. SMITH, H. M., TANIS, H. E., AND WINSLOW, E. H. Sol **and liquids.** *Industr. Engng Chem. (Analyt. Edit.)* 861–5 (*Nov.*, 1947).—Routine analysis is now possib using available phosphors and multiplier tubes. An X-r photometer is described [Abstr. 1539 (1947)] and resu of measurements on various solids and liquids report and discussed.

Gases. *Ibid.*, 866–7.—Promising results obtained 6 gases are reported.

545.827 22

Recording mass spectrometer for process analys NIER, A. O., ABBOTT, T. A., PICKARD, J. K., LELAN W. T., TAYLOR, T. I., STEVENS, C. M., DUKEY, D. L., A GOERTZEL, G. *Analyt. Chem.*, **20**, 188–92 (*Mar* 1948).—A recording mass spectrometer is described whi has been used for making continuous analyses of t process gas stream in the U gaseous diffusion pla The strategic distribution of instruments in the pla assures rapid detection of any inleaking contaminan Modifications of the system described should prove use in other large industrial installations.

545.828 : 537.542 22

An investigation of the use of Geiger–Müller phot electron counters in the spectrographic analysis of pho phorus in steel. HANAU, R., AND WOLFE, R. A. *J. Op Soc. Amer.*, **38**, 377–83 (*April*, 1948).—The constructio of the counters and the methods of electrically shieldi and mounting them on the Littrow spectrograph a briefly described. The adjustments of counter orientatio slit widths, and focus are discussed with reference to t analyses of ferrous alloys where good resolution necessary. Because of the absorption of radiation quartz at low wavelengths, both absolute and relati intensities are dependent upon the position of the arc c the electrode surface. This effect, which results appreciable error in the measured % composition of sample, is investigated photographically and with G counters, and several methods of reducing the effect a discussed. The effect of temperature changes of t dispersing prism on line position is investigated and suitable method of control is mentioned.

CRYSTALLOGRAPHY 548

548.0 : 534.321.9 2243

Ultrasonic studies in amethyst and smoky quartz. KRISHNAMURTY, B. *Proc. Indian Acad. Sci. A*, **27**, 132–7 (*Feb.*, 1948).—Elastic frequencies and densities of amethyst and smoky quartz are not changed on complete decolorization by heating. It is therefore improbable that colour is due to metallic impurities. The colour displayed by the two types does not appear to arise from a common cause. W. R. A.

548.0 : 535.32 *see Abstr.* 2064

548.0 : 535.375.5 = 4 *see Abstr.* 2092

548.0 : 535.551 : 539.319 *see Abstr.* 2214

548.0 : 537.226.08 *see Abstr.* 2116

548.0 : 539.164.08 *see Abstr.* 2186

548.0 : 549.211 : 539.166.08 *see Abstr.* 2191

548.24 : 621.396.611.3 224

The control and elimination of electrical (Dauphin twinning in quartz. WOOSTER, W. A., WOOSTER, N RYCROFT, J. L., AND THOMAS, L. A. *J. Instn Elect. Engr Pt IIIA*, **94** (*No.* 16) 927–37 (1947).—A survey of th experimental methods used in untwinning quartz. Th basis of these methods is a heat treatment of the quart plate while subjected to a system of stresses applied t the plate by temperature gradients, pure bending, longi tudinal compression or torque. The effect of crystallo graphic orientation is discussed, and the new physica phenomenon of "piezo-crescence" is defined. Th application of the untwinning techniques to quartz crystal plates is described, with particular reference to th requirements of telecommunication. Heat treatment wit an applied torque may be successfully applied to man important types of quartz crystals, including the BT an

cuts. The proportion of success and the occurrence uartz showing anomalous behaviour are discussed. A.
5 2245

ie growth of barium titanate crystals. MATTHIAS, B. *Rev.*, **73**, 808–9 (*April* 1, 1948).—[Cf. Abstr. 1863, (1947)]. For best results 50 g $BaCl_2$, 25 g $BaCO_3$, TiO_2 are melted in Pt or C crucibles under N_2, and ed from 1 200° to 800°C in a few hours. A. J. C. W.
5 : 539.211 : 669 2246

istory of crystal growth revealed by fractography. PFE, C. A., LANDGRAF, F. K., JR., AND WORDEN, O., JR. *Science*, **107**, 320–1 (*March* 26, 1948).—ctography, the study of fracture facets of individual tals at high (140–2 000×) magnifications, may reveal only the stress pattern existing at the moment of ture, but also inherent imperfections. Thus H_2PO_4 shows a mossy dendritic structure as well stress pattern, and ξ-FeSi a characteristic terraced rn. A stainless steel (Cr 28%, C 0·10%) shows a grained cleavage on (100). Alloys of only slightly erent composition are readily distinguished from another. A. J. C. W.
.5 : 539.23 2247

Crystallite orientation in coating films. III. Orientation silver iodide upon silver bromide. SCHWAB, G.-M. *ns. Faraday Soc.*, **43**, 715–23 (*Nov.–Dec.*, 1947).—l films formed by exchange coating of AgBr in iodide utions were examined by X-rays to obtain their lattice entation. As long as they do not undergo recrystal-tion or polymorphous change, they belong to the agonal modification and grow upon the lattice of the ic bromide crystal such that the hexagonal basis (001) ncides with the octahedral plane (111) of the bromide. th planes have the same closest hexagonal arrangement atom and contain ions of one sign only. Because of s, the phenomenon differs from the formation of the er Ag halides on each other or on Ag. In the coating ne the distances of nearest neighbours differ by as ch as 13%. This probably is allowed for because of lack of polarity in the plane and of the similarity of ion distances Ag–Br and Ag–I. This, caused by the formability of the I ion, makes the formation of mixed mplexes possible, having the co-ordination number of e of the lattices, in the transition layer. A.
8.5 : 539.23 2248

Crystallite orientation in coating films. IV. Orientated ating films on thallous halides. SCHWAB, G.-M. *Trans. raday Soc.*, **43**, 724–33 (*Nov.–Dec.*, 1947).—The ystalline orientation in films formed by chemical actions on the surface of Tl halide monocrystals was amined by X-rays. On TlCl, films of TlBr grow up in isomorphously orientated arrangement, forming termediate mixed crystals; TlI does not do so, and gCl is orientated. On TlBr, an isomorphous orientated ixed crystal, rich in TlI, is formed; AgBr is orientated o. On (110) of TlBr, the (110) of AgBr builds up, the ystallographic axes within these planes being per-ndicular to each other. This orientation of a NaCl ttice on a CsCl lattice is energetically much more voured than the (100) on (100). In the usual micro-opic technique it cannot be detected because (110) is ot a cleavage face of the NaCl lattice. All the orientated atings described agree with the rules stated previously the author. A.
8.5 : 550.311.122 *see Abstr.* 2263

8.538 = 4 2249

On the subject of a new mode of deposition of potassium loride on the micas. ROYER, L. *C.R. Acad. Sci., Paris,* **226**, 95–6 (*Jan.* 5, 1948) *In French.*—Remarks on the reported crystallization of KCl on cleaved mica with (001) on the cleavage plane and [110] and [1$\bar{1}$0] || to [100] and [010] of the mica [Deicha, *Bull. Soc. Franç. Minéral.*, **69**, 16, 19 (1946)]. A. J. C. W.
548.538 = 4 2250

Some considerations on the cube-face orientation of potassium chloride on the micas. ROYER, L. *C.R. Acad. Sci., Paris,* **226**, 262–4 (*Jan.* 19, 1948) *In French.*—[See Abstr. 2249 (1948)]. It is suggested that very small crystals of KCl formed in the solution and falling on cleaved mica are orientated so that approximate coincidence of interatomic spacings is achieved in one direction only. The situation would then be similar to that in the "singly periodic twins" of Friedel [*Bull. Soc. Franç. Minéral.*, **56**, 269 (1933)]. A. J. C. W.
548.7 2251

Normal vibrations of a crystal lattice. HOUSTON, W. V. *Rev. Mod. Phys.*, **20**, 161–5 (*Jan.*, 1948).—The frequency spectrum of a simple cubic lattice is approximated by interpolating between the "exact" solutions of the secular equation for the directions [001], [011], [111], by means of associated Legendre polynomials. The method exaggerates the peaks in the frequency distribution function, but it is argued that at least those associated with [001] have physical reality. Agreement is moderate with Blackman's numerical solution [Abstr. 1444 (1937)], which, in common with all previous approximations, underestimates the peaks. A. J. C. W.
548.7 : 536.63 2252

The vibrational spectrum and specific heat of a face-centered cubic crystal. LEIGHTON, R. B. *Rev. Mod. Phys.*, **20**, 165–74 (*Jan.*, 1948).—The "exact" frequency spectrum is found for the symmetry planes of a cubic lattice, and is interpolated by modelling the surfaces of constant frequency in plaster. The volumes corresponding to various frequency ranges are then measured, and the heat capacity as a function of a parameter β, depending on the absolute temperature and the elastic constants, is calculated numerically. Substitution of the elastic constants of Ag gives satisfactory agreement with the experimental variation of the characteristic temperature θ in the range 10°–50°K, but the theory fails to account for the sharp peak in θ at ~ 5°K. It is concluded that the variation of θ at very low temperatures is not explained by the difference between the frequency spectrum of a continuum and that of an atomic lattice. A. J. C. W.
548.7 : 539.11 2253

On the dynamics of the RbI crystal. HOFFMANN, T. A. *Hungar. Acta Phys.*, **1** (*No.* 2) 34–54 (1947).—The lattice constant, compressibility and infra-red wavelength are calculated using an improved statistical model due to Gombás [Abstr. 380 (1946)] with a modified potential, including correlation effects. Estimations of the lattice energy and tensile strength are made. A.
548.7 : 539.11 = 3 2254

On the theory of metals. GOMBÁS, P. *Hungar. Acta Phys.*, **1** (*No.* 2) 1–33 (1947) *In German.*—A simple theory of the alkali and alkali-earth metals is formulated in terms of the improved statistical model with a modified potential [Abstr. 1150 (1944)]. It furnishes in a simple fashion all the important structure constants and also a relation between the pressure and density of a metal is obtained. A.
548.73 : 621.385.15.08 2255

The application of electron multipliers for the measurement of X-ray intensities and for the determination of crystal structures. PAPP, G., AND SASVÁRI, K. *Publ.*

Univ. Tech. Sci., Budapest (*No.* 2) 171–80 (1947).—[Abstr. 1783 B (1948)].

548.733 2256

An X-ray goniometer for the study of preferred orientation in polycrystalline aggregates. WOOSTER, W. A. *J. Sci. Instrum. Phys. Ind.*, **25**, 129–34 (*April*, 1948).—An X-ray goniometer based on the design originally proposed by Kratky is described. The theory of the interpretation of photographs is given, together with two types of charts which when superimposed on the photographs enable a pole-figure, based on a stereographic projection, to be obtained. The particular virtue of this method is that almost the whole information required for a complete pole-figure may be obtained from one photograph. A.

548.734.3 : 535.314 2257

Effect of refraction upon accuracy in X-ray powder diffraction patterns. SHEARER, J. *Phil. Mag.*, **39**, 235–40 (*March*, 1948).—The effect is studied when the ray enters and emerges by (*a*) the same face, (*b*) different faces. The approx. error in Debye–Scherrer diffraction patterns, when refraction is neglected, is calculated for materials like clay and mica. L. S. G.

548.735 2258

Method of steepest descents: improved formula for X-ray analysis. VAND, V. *Nature, Lond.*, **161**, 600–1 (*April* 17, 1948).—In the final stages of Booth's approximation method [Abstr. 2998 (1947)] account must be taken of the fact that average errors $\propto$ intensities, and the errors themselves do not obey Gauss's law. Thus $R_3 = \Sigma(\log I_0 - \log I_c)^2$ should be minimized. A procedure is outlined.

548.736.3 2259

The structures of the carbides, nitrides, and oxides of uranium. RUNDLE, R. E., BAENZIGER, N. C., WILSON, A. S., AND MCDONALD, R. A. *J. Amer. Chem. Soc.*, **70**, 99–105 (*Jan.*, 1948).—The following data have been obtained from X-ray study: *Carbides*: UC is face-centred cubic (NaCl type) with $a = 4{\cdot}951$ Å; UC_2 is body-centred tetragonal (Ca carbide type) with $a = 3{\cdot}517$, $c = 5{\cdot}987$ Å; U_2C_3 probably exists at 200° but does not exist at room temp.; UC_2 dissolves C at high temp. *Nitrides*: UN is face-centred cubic (NaCl type) with $a = 4{\cdot}880$ Å; U_2N_3 is body-centred cubic (Mn sesquioxide type) with $a = 10{\cdot}678$ Å; UN_2 is face-centred cubic (fluorite type) with $a = 5{\cdot}31$ Å; U_2N_3 changes gradually to UN_2. *Oxides*: UO is face-centred cubic (NaCl type) with $a = 4{\cdot}92$ Å; UO_2 has a fluorite-type structure v $a = 5{\cdot}4581$ Å; U_2O_5 is orthorhombic with $a = 8$ $b = 31{\cdot}65$, $c = 6{\cdot}72$ Å and its structure is related to th of U_3O_8 and UO_3. W. R.

548.736.34 : 539.153 2

The UCl_3 type of crystal structure. ZACHARIAS W. H. *Phys. Rev.*, **73**, 254 (*March*, 1948).—Hexago $a = 7{\cdot}428 \pm 3$, $c = 4{\cdot}312 \pm 3$ Å, space group $C6_3$ 2 U in $\pm(\frac{1}{3}, \frac{2}{3}, \frac{1}{4})$, 6 Cl in $\pm(x, y, \frac{1}{4})$, $(\bar{y}, x-y, \frac{1}{4})$, $(y-x, \bar{x}$ $x = 0{\cdot}374 \pm 14$, $y = 0{\cdot}292 \pm 14$. The chlorides Ac, Np, Pu, Am, La, Ce, Pr, Nd; the bromides of Ac, Np, La, Ce, Pr; and the hydroxides of La, Pr, Nd h the same structure. The relative lattice dimensions sh that electrons enter the 5*f* shell in the heavy elem series. A. J. C.

548.736.4 2

An X-ray investigation on bismuth oxyfluoride. AU VILLIUS, B. *Ark. Kemi Min. Geol.*, **26 B** (*Paper* 2) 6 (1948).—BiOF is tetragonal, space group $P4/nm$ $a = 3{\cdot}748$, $c = 6{\cdot}224$ Å. The proposed layer structu based partly on analogy, has 2Bi in (*c*), $z = 0{\cdot}2$ 2F in (*c*), $z = 0{\cdot}65$; and 2O in (*a*). A. J. C.

548.736.442 + [537.531 : 535.43] 22

The crystal structure of ammonium nitrate III, atomic scattering factors in ionic crystals. GOODW T. H., AND WHETSTONE, J. *J. Chem. Soc.*, 1455 (*Nov.*, 1947).—Crystals of NH_4NO_3 III, stable betwe $32{\cdot}3°$ and $84{\cdot}2°$C, were grown in a thermostat at 5 transferred to the camera and kept at $\sim 42°$ by stream hot air over them. The crystals were orthorhomb $a = 7{\cdot}14$, $b = 7{\cdot}65$, $c = 5{\cdot}83$ Å, probable space gro *Pbnm*, forming needles bounded by (110) and (1 The structure proposed by Hendricks *et al.* [*J. Am Chem. Soc.*, **54**, 2776 (1932)] does not give good agr ment with the observed intensities, and a variation proposed, with the plane of the NO_3 groups $\sim \|$ instead of $\sim \| b$. It is considered that the scatteri factor of N $\simeq$ that of O, and not $\sim \frac{1}{2}$ of it, as assum by Hendricks *et al.* A. J. C.

548.74 : 539.185 *see Abstr.* 2209

MINERALOGY 549

549.211 : 537.312.5 *see Abstr.* 2120

549.211 : 548.0 : 539.166.08 *see Abstr.* 2191

549.623.5 : 538.22 *see Abstr.* 2159

GEOPHYSICS 55

550.311.122 : 548.5 2263

Growth of glacier crystals. SELIGMAN, G. *Nature, Lond.*, **161**, 485 (*March* 27, 1948).—"Rubbings" of glacier crystals are shown. The size seems to be less than has been previously reported, and in some circumstances is very small. There seems to be some relationship between crystal size and inclination of glacier bed.

550.34 2264

Seismological research in Great Britain. *Nature, Lond.*, **161**, 615–17 (*April* 17, 1948).—Summarized report to the British Association (Sept., 1947), covering the years 1942–7.

550.38 2265

The main geomagnetic field. CHAPMAN, S. *Nature, Lond.*, **161**, 462–4 (*March* 27, 1948).—A short account of a discussion. A new theory of secular magnetic variation was outlined, dependent on an evolving magnetic dipole near the surface of the earth's liquid core caused circulatory eddy motion. Measurements were report on the permanent magnetization of some Engli volcanic dykes, which was found to be in the oppos direction to the present local field, indicating that t earth's field has reversed in the last 50 million yea other similar examples were given.

550.384.4 22

Daily variation of the horizontal magnetic force at t magnetic equator. EGEDAL, J. *Nature, Lond.*, **161**, 443 (*March* 20, 1948).

550.384.4 : 551.510.535 22

Electrical conductivity of the ionospheric *D*-lay COWLING, T. G., AND BORGER, R. *Nature, Lond.*, **16** 515 (*April* 3, 1948).—Martyn's suggestion [Abstr. 4 (1948)] is shown to imply an integral conductivity in t *D*-layer far higher than is probable, on the assumpti

t tidal motions tend to increase, if anything, with ght. A layer of the required conductivity can, in fact, rcely exist at all anywhere below the *E*-layer.

.42 : 537.591 : 539.172 *see Abstr.* 2199

ATMOSPHERE . METEOROLOGY 551.5

.510.535 : 523.755 : 523.746 *see Abstr.* 1989

.510.535 : 538.566.3 2268

Triple splitting of ionospheric rays. MEEK, J. H.; KERSLEY, T. L. *Nature, Lond.*, **161,** 597–8 (*April* 17, 48).—Records obtained at Churchill, Canada, of triple itting extending from the *E* region through the F_1 to F_2 region are reported, and a sample is reproduced.

.510.535 : 550.384.4 *see Abstr.* 2267

.510.535 : 621.396.11 = 4 2269

The influence of wind [in the ionosphere] on the frequency radio waves. JOUAUST, R. *C.R. Acad. Sci., Paris,* -30 (*Jan.* 26, 1948) *In French.*—[Abstr. 1823 B 48)].

.510.535 : 621.396.11 2270

Magneto-ionic multiple refraction at high latitudes. ATON, S. L. *Proc. Inst. Radio Engrs, N.Y.*, **36,** 450–4 *pril*, 1948).—[Abstr. 1822 B (1948)].

.510.535 : 621.396.91 2271

The accuracy of sky-wave delay measurements. ARROD, K. W. G. *J. Instn Elect. Engrs, Pt IIIA*, **94** *o.* 16) 893–8 (1947).—[Abstr. 2054 B (1948)].

.510.535.08 : 621.396.91.08 2272

High-power ionosphere-measuring equipment. SULZER, G. *Proc. Inst. Radio Engrs, N.Y.*, **36,** 389–94 (*March,* 48).—[Abstr. 1590 B (1948)].

.515 = 4 2273

Theory of short waves at the tropopause. QUENEY, P. *R. Acad. Sci., Paris,* **225,** 1351–3 (*Dec.* 22, 1947) *In ench.*—The theory is a development of earlier sum- arized results. The problem investigated is of free iabatic slow moving waves in a permanent zonal air rrent in which (*a*) the hydrostatic stability has a uniform lue in the troposphere and another greater value in e sub-stratosphere, and (*b*) the speed of the current stwards is a linear function of height of the form $= u_s + yz$ where u_s is a constant and the coefficient has a value constant in each of the two zones and quires a horizontal gradient of temperature in each region and a slight slope of the tropopause. The principal characteristics of the waves are described.

R. S. R.

551.521 : 535.245.2 : 771.376.2 *see Abstr.* 2288

551.521.3 : 535.343.4–15 *see Abstr.* 2081

551.578.1 : 536.423.4 = 4 2274

Artificial production of rain. BRUN, E., AND DEMON, L. *C.R. Acad. Sci., Paris,* **225,** 953–4 (*Nov.* 17, 1947) *In French.*—Experiments made earlier with solid CO_2 were repeated with liquid air and similar results obtained, showing that temperature and not the solid particle is the important agent. With tests under a microscope on crystals and liquid drops side by side, it was found (*a*) in absence of fog the crystals evaporate less quickly than water drops, (*b*) in fog the crystals grow the more rapidly, (*c*) most crystals maintain a hexagonal symmetry, (*d*) crystals of the order of several microns double in size in ~ 1 min. The results support the rain theory of Findeisen.

R. S. R.

551.579.3 : 627.8 = 5 2275

Irrigation [and drainage] canals. Maximum rainfall compatible with safety, compared with climatic variability. PUPPINI, U. *Energia Elett.*, **25,** 20–3 (*Jan.–Feb.*, 1948) *In Italian.*—[Abstr. 1852 B (1948)].

551.594.221 : 537.521 = 82 2276

Structure and parameters of a leader discharge. KOMELKOV, V. S. *Bull. Acad. Sci. URSS, Dep. Tech. Sci.* (*No.* 8) 955–66 (1947) *In Russian.*—Current theories of nature and structure of the leaders and streamers initiating a lightning discharge are discussed critically and submitted to an experimental investigation. The method used is described in detail, also the oscillographing and photographing technique. Conclusions arrived at are: the leader has three distinct zones: ionization zone consisting of a series of low glowing diffused streamers, the actual leader channel and the cylindrical body of the space charge. The average gradients in the streamer zone reach 6 to 10 kV/cm. Conductivities, gradients and current densities in the leader channel are of the same order as in an arc.

A. L.

551.594.221 : 621.316.99 2277

Impulse characteristics of the ground under direct discharges and with pointed electrodes. NORINDER, H., AND PETROPOULOS, G. *Ark. Mat. Astr. Fys.*, **35 A** (*Paper* 26) 23 *pp.* (1948).—[Abstr. 1709 B (1948)].

BIOLOGY 57/59

.1.488.4 2278

Oscillographic analysis of the non-acoustic functions of e vertebrate ear. LOWENSTEIN, O. *Nature, Lond.*, **161,** 2–4 (*April* 24, 1948).

EDICAL SCIENCE . HUMAN PHYSIOLOGY 61

.? 843.32 : 535.642.1 2279

A new determination of the Young–Helmholtz primaries. EFKERES, G. *J. Opt. Soc. Amer.*, **38,** 350–64 (*April,* 948).—The determination is based solely on colour- ixture data pertaining to the trichromatic observer. he primaries can be derived from the colour-mixture ata of the average trichromate with reasonably small ncertainty, if only the one hypothesis is made that each f the 3 response functions has a certain simple geo- etrical character, resembling the standard luminosity nction. This hypothesis is suggested by the purely hysico-chemical character of the retinal process. An nalysis of the situation shows that in order to explain the behaviour of colour-blind observers by the response functions thus obtained it is necessary to assume that "inner" dichromatism—such as deuteranopia—consists not in the absence of one of the fundamental responses, but in the failure of the mental organ to distinguish qualitatively between two of the fundamental responses. A satisfactory quantitative account is given of all the known forms of dichromatism.

A.

612.843.6 : 621.397.3 2280

Electro-optical characteristics of television systems. SCHADE, O. H. *RCA Rev.*, **9,** 5–37 (*March,* 1948).—[Abstr. 2061 B (1948)].

612.845.6–073 2281

Testing for nyctalopia (night-blindness). FREDERIK, W. S. *Philips Tech. Rev.*, **9** (*No.* 7) 211–14 (1947).—Describes a test for night-blindness designed to prevent malingering. A chart is prepared with portions of letters having different reflection factors, so that as the illumina-

tion is gradually increased different sets of letters can be detected successively. J. W. T. W.

612.858.7 : 534.75 2282

Construction material of the sound conduction system of the human ear. KOBRAK, H. G. *J. Acoust. Soc. Amer.*, **20**, 125–30 (*March*, 1948).—Two elementary structural elements possessing restoring forces are the collagen fibre and the elastic fibre. These two tissue elements form membranes, ligaments, tendons, and articulations in the ear. The physical behaviour of these two fibre systems is described. Three areas in the ear are distinguished according to their construction material. Methods of measuring the physical characteristics of the ear structures are described. The linear displacement of the centre of the ear drum as a function of static pressure changes in the outer ear canal is given. Static movements of the stapes footplate due to reflectoric muscle contractions were used to calculate the elongation of the stapes ringband in vivo. A.

612.858.71 2283

The perception of short bursts of noise. MILLER, G. A. *J. Acoust. Soc. Amer.*, **20**, 160–70 (*March*, 1948).—Short bursts of random noise were used to study the perceptual growth and decay of the noise experience. Noise, unlike sinusoidal tones, does not change materially in spectrum as the duration of the sound is varied. A short burst of noise must be more intense in order to be equal in effectiveness to a longer noise. Thus the threshold of hearing is lowered by increasing the duration of the noise up to durations at least as long as 1 sec. The loudness of an intense noise, however, depends upon its duration up to durations of only 65 msec. Judgments of the slowest rate of decay of a noise which sounded indistinguishable from an abrupt termination also led to the concept of a critical time of approximately 65 msec for the sensation to decay to threshold from any steady magnitude of stimulation. It is inferred that the auditory system acts as if the growth and decay periods of the noise perception depend upon differences in latencies among the various neural paths in transmitting the cochlear activity to the higher centres in the brain. By means of this hypothesis it was possible to predict the judgments of time of termination of noises in the two ears when the intens of the noise differed between them.

612.858.71 22

The perception of repeated bursts of noise. MILL G. A., AND TAYLOR, W. G. *J. Acoust. Soc. Amer.*, 171–82 (*March*, 1948).—Noise interrupted at a stea rate has essentially the same spectrum over the range frequencies transduced by the earphone as has continuo noise. The frequency corresponding to the rate interruption is not intensified in the spectrum. Co sequently, the ability of listeners to respond differentia to the rate of interruption cannot be explained on t basis of a simple resonance theory of hearing. The poi at which an interrupted noise becomes indistinguishab from a continuous noise depends upon the rate interruption, the sound-time fraction, and the intens of the noise. For a sound-time fraction of 0·5, t presence of interruptions can be detected at rates 1 000/sec. Differential sensitivity to changes in the ra of interruption (with a sound-time fraction of 0·5) poor above 250 interruptions/sec. Also at these hi rates the listener loses his ability to match the frequen of a pure tone to the rate of interruption. Experimen were carried out illustrating these effects.

612.858.71 : 534.414 22

Phase memory of the ear: a proof of the resonan hypothesis. PUMPHREY, R. J., AND GOLD, T. *Natur Lond.*, **161**, 640 (*April* 24, 1948).—It has been found th an ear stimulated by a train of 5 kc/s sine waves ca distinguish whether a succeeding train is or is not phase with the first if the interval between the trains > 30 cycles. Thus the hearing mechanism must resonant, with $Q < 100$. [See Abstr. 3391 (1947)].

615.83 : 534.321.9 = 3 22

Ultrasonic treatment, a new branch of physical therap FIEDLER, G. *Frequenz.*, **1**, 56–9 (*Nov.*, 1947) *In German.* A short review of the physics of ultrasonics and of t first technical and biological applications, with account of the therapeutic effects, especially in the ca of sciatica, neuralgia and cancer. The Siemens–Reinig equipment giving an output of 40 W at 800 kc/s in wat is briefly described. A.

GLASS . CERAMICS 666

666 : 539.389.3 *see Abstr.* 2218–19

666.1.056.5 : 531.259 2287

The effect of various treatments on the stresses in glass-to-metal seals. REDSTON, G. D., AND STANWORTH, J. E. *J. Sci. Instrum. Phys. Ind.*, **25**, 138–40 (*April*, 1948).

METALLURGY 669

669 : 539.211 : 548.5 *see Abstr.* 2246

669.1 : 539.26 *see Abstr.* 2213

669.14 : 620.179.15 : 531.717.1 *see Abstr.* 2023

669.231 : 621.316.84 : 537.311.1 = 4 *see Abstr.* 2118

681.4 : 535.315 *see Abstr.* 2060

PHOTOGRAPHY 77

771.376.2 : 551.521 : 535.245.2 2288

Sunlight and skylight as determinants of photographic exposure. I. Luminous density as determined by solar altitude and atmospheric conditions. JONES, L. A., AND CONDIT, H. R. *J. Opt. Soc. Amer.*, **38**, 123–78 (*Feb.*, 1948).—The various factors influencing correct camera exposure are discussed, and a simplified exposure formula deduced. A long critical discussion is given of available data on the amount of light reaching the earth from the sun and the sky, and its applicability for the compilation of exposure guides. A relatively new concept, the *volume density of luminous energy*, is introduced, representing energy reaching the earth's surface regardless of direction, and it is shown to be a more reliable basis of evaluation of minimum scene luminance. Tables of average value for various times and localities, are given. Atmospher indices, applying to various conditions of unclear atm sphere, are also evaluated (53 references are given).

772.1 : 541.183.5 : 541.143 *see Abstr.* 2228

778.333 : 535.371.07 *see Abstr.* 2089

778.34 : 537.533.7 *see Abstr.* 2134

778.37 : 531.55 : 621.327.4 22

A microflash unit for ballistic photography. McCo MICK, W. W., MADANSKY, L., AND FAIRBANKS, A. *J. Appl. Phys.*, **19**, 221–5 (*March*, 1948).—[Abstr. 1758 (1948)].